Electrical World

The consolidation of Electrical World and Engineer and American Electrician.
Published by McGraw Publishing Company, Inc.

Vol. 66 NEW YORK, SATURDAY, OCTOBER 2, 1915 No. 14

The International Engineering Congress

BRIMFUL with enthusiasm and optimism was the cup of good fellowship offered the engineers of the country who attended the International Engineering Congress at San Francisco last week, and they drank of it to the full. But the congress, with its manifold activities and with its vigorous and refreshingly frank discussion of topics on which Western engineers are particularly qualified to speak, was but a part of each visitor's return. Only to see the West and its great engineering works gives one a newer vision and a clearer conception of the calling of the engineer. There everyone appreciates the constructive and sympathetic genius by which and through which the wealth of nature has been unfolded, developed and translated into permanent prosperity. Often when the burdens of great undertakings have fallen on the shoulders of engineers the credit has been accorded to others. This was not so in the West. A gratifying feature was "Engineers' Day" at the Exposition, when public recognition was made of the engineer's work in that artistic monument. To San Francisco and to the committee of management credit is due for the excellence of the congress arrangements and for the hospitality that lacked nothing. Considering all of the circumstances, it was a monumental feat to have an international congress at all; but San Franciscans have again lived up to their reputation of accomplishing the next to impossible.

Simplicity and Science

MYSTERY and science are unnatural partners. When the greatest scientists express themselves in writing, their words as well as their reasoning are clear and comprehensive. Modern engineering and scientific writing occasionally err in lacking simplicity. There seems to be a tendency to crowd sentences with unusual words, to find terms and to coin phrases which in themselves are almost meaningless and have to be read with a background of subconscious knowledge of the subject in order to be interpreted. Perhaps this is a fault of youth. Perhaps younger men are confusing heaviness of expression with weight of thought. It is pleasant to record, however, that in one of the newest branches of engineering expression has been given in the recent presidential addresses to the ideals of simplicity. Dr. A. S. McAllister, the retiring president of the Illuminating Engineering Society, presented a method of mathematical analysis of illuminating engineering problems which had for its keynote the simplification of all such calculations. Dr. Steinmetz, the incoming president, in his address outlined the fundamentals of the problem in what one listener termed a luminous summary of progress. The leaven of simplicity is good for all of us, including editors. We need more luminous summaries.

Lighting Industry Still Forges Ahead

RETURNS collected by the Electrical World show that at the end of the first year of the European war the central-station industry was still moving forward. This is indeed encouraging, considering the handicap which that struggle has placed on many of the industries of the country. During the same period other commodities, like steel and cotton, did not even approach normal, although during recent months the output of steel has become enormous and the demands now tax the facilities of the country. There are, of course, reasons for this showing by the electrical industry. When confronted by depressions the central stations usually increase their activities for more business. As Frank Vanderlip has expressed it, "The quality of management in the electrical business is, on the whole, better, more scientific, more clear-sighted in regard to methods, and more co-operative in the interchange of useful opinion, than any other important industry." If money is too costly, extensive developments are curtailed and intensive development begins. The industry is thus able to show material growth without great expenditures of new capital. However, during the period under discussion the central-station industry had not only to contend with the general depression in business and the consequent economy enforced on the general public because of it but was also brought face to face with the higher efficiencies of translating devices, especially the tungsten lamp, which has now come into almost universal use. That it has met both these situations so successfully speaks well for the soundness of the industry as a whole.

Shrinkage Between Energy Made and Energy Sold

AN examination of the returns of energy generated and energy sold by any large central station brings out facts which, while really well known to engineers, are half forgotten. It is not unusual to find that from one-quarter to one-third of the energy generated is somehow lost in the shuffle and is not paid for in the day of reckoning with the customer. Now, a commodity which shows a shrinkage of 30 per cent or so deserves more than casual attention on the part of those who deal in it, and it would be an exceedingly good thing for the central-station

business if a careful analysis were customarily made of the sources of loss which affect the electrical energy between the busbar and the consumer's meter. It is a subject to which attention has not been sufficiently devoted, in spite of the full realization of the unpleasant facts. Some stations do actually keep a fairly careful reckoning of the various losses which are incurred, but most do not, and all owe it to themselves to institute an inquiry as to the nature and amount of their losses and the means of prevention.

There is no doubt at all that the average electrical distribution from busbar to consumer is very much less efficient than it is credited with being, merely in the matter of energy losses in the lines. Station men sometimes talk very cheerfully about the low drop in their circuits without speaking by the card from actual tests. A system of feeders and mains may be planned originally for small losses, but by the time the service has been fairly well filled up there is serious trouble, usually noticed first in a lack of regulation, but continually eating away at the balance sheets of the station. It is not the loss at full load, which rarely comes on any normal distributing system, that makes the trouble; it is the continuing losses all over the system at partial loads, and these must be carefully looked after if the energy sold and paid for is to come anywhere near that which is generated. Very often feeders and mains are planned with liberality, and then as a matter of convenience calmly overloaded until the drop instead of being 3 per cent or 5 per cent is 10 per cent or 15 per cent. It is so serious a matter to run a new circuit, particularly if underground, that it is very generally dodged and put off until the last minute. Meanwhile the efficiency of the system is suffering.

The figures for lost current are practically just as bad in some of the big city stations as they are in the little plants that serve most rural communities. The reason for this unhappy common lot is that what the big stations lose in overloaded conductors the little stations lose in underloaded transformers. The modern transformer is a marvel of efficiency even at varying loads, but it has a core loss which goes on twenty-four hours per day and 365 days in the year. It is with the central station first, last and always, and while it may not be more than 2 per cent of the energy transformed at full load, it is anywhere from 50 to 100 per cent at times of light and no load. During the hours of daylight most of the transformers, numerically speaking, on the average system are run merely for core loss, which may easily aggregate during this period almost as much as the whole output during the evening lighting time. A big station with widespread mixed distribution gets caught both by its long feeders and by its transformer losses, so that it is not much better off than if it were less imposing in total aggregate output.

Attention should be given to this matter particularly, because it is one which grows on the station and attains serious dimensions before anybody realizes that things are going badly. As things are now, anything less than 20 per cent shrinkage in energy between production and sales is extraordinarily good practice reached by relatively few stations. The gas companies, despite accusations of bad service and leaky mains, show a good deal better record in actual shrinkage than the electric companies, and 25 per cent loss would be fit to make a gas manager rave and discharge most of the heads of departments for incompetency. Perhaps the ice business may show a worse shrinkage than electrical distribution, but 30 per cent or 35 per cent is a figure hard to beat. The long and short of the whole matter is that most electrical systems are not planned—they just grow—and without negligence fairly chargeable to anybody in particular the losses pile up unpleasantly. The remedy is obvious—more copper where it is needed, and the use so far as possible of networks both for primary and secondary, fed by large transformers with relatively small core loss, for the core loss works overtime and falls heavily on widespread distributions. As the first preliminary toward remedy there is acutely needed closer examination of the network and more exact location of the energy losses than is now common.

Eliminating Excuses for Runaway Engines

The explosion of a steam boiler sets free in an instant an enormous quantity of stored energy, and it is the sudden release of this energy that causes the destruction of life and property. It would seem that by this time engineers should have come to realize that wherever energy is stored in a form that may easily become destructive if suddenly set free ample precautions should be taken to prevent its liberation except in safe and desired channels; yet there are hundreds of power plants in which the flywheels of steam engines are run daily with absolutely no provision against overspeeding except the action of the governor. It is true that the governor, if correctly adjusted and maintained in good order, will prevent the engine from attaining too great a speed; but governors are subject to derangements. Let there be the parting of a governor driving belt, the sticking of a lever on its pin, the breaking off of a weight, and there may be nothing to prevent a runaway engine except the watchfulness and prompt action of an engineer. A flywheel weighing twenty tons or more, speeded up to the point at which rupture will occur, has accumulated a store of energy that is bound to cause considerable damage if suddenly released by the breaking of the wheel. Accidents of this nature, commonly called flywheel explosions, are all too frequent, and result in almost as much destruction as the explosion of a steam boiler.

It is possible to safeguard life and property against such accidents by the adoption of some form of safety stop. This device, which is made in different forms, comes into action as soon as the speed of the engine increases to a point somewhat above the normal running value, and throws the valves into such positions

that the engine cannot take steam, or acts on the main throttle and prevents steam from passing to the engine at all. In addition, it is usually so arranged that it may be set in operation from one or more stations throughout the plant, thus making it possible to shut down the engines immediately in case of the failure of other parts of the plant equipment. It is one of the few power-plant accessories that may not be operated except while it is being tested to show that it is in good working condition, and it is therefore apt to be regarded as yielding no return on the amount invested in it. But it will prove to be an inexpensive form of accident insurance.

An Asset That Never Depreciates

The customer's eye sees first the things that affect him personally, and the effect of a disappointing personal experience is ten times as powerful and far-reaching as the influence of good service, for the simple reason that bad news travels faster always. If a customer comes into the office of a lighting company to pay his bill and is greeted cordially by the cashier and receives such treatment that he goes away smiling, he is not apt to talk about it to his friends. Courtesy and good-natured fair dealing are expected nowadays, and though the enjoyment is no whit less, they do not occasion comment. However, let the man who comes to pay his bill encounter the dark looks and short answers that are so freely dispensed by the clerk who is temperamentally afflicted with an uncontrolled and chronic grouch, and the customer walks out with a feeling of irritation that will outlive and outwork any good impression that could possibly be implanted there. The man who has been offended can't help remembering, and there are very few of us who do not talk about the offense while the sting is felt. No one can tell how far the word will spread nor with what accumulation of hurtful influence.

New Sources of Load

The central-station manager is constantly on the look-out for new opportunities for disposing of his product. The lighting business is pretty well developed, yet could be pushed much further in the matter of residence lighting. The ordinary "power" service, too, has had much attention, and efforts are now directed toward the larger commercial use of electricity for electrochemical work and various heavy tasks as yet hardly touched. The heating business has been worked at in some of its rudimentary forms and constitutes perhaps the largest unexploited field for the use of electrical energy. The one consideration that has commonly stood in the way is excessive expense. We are interested to note that the Boston Edison company is just promulgating a schedule of rates deliberately intended to reach the heating and cooking field as well as that of refrigeration and analogous processes. The point of the schedule is its low secondary rate, 2 cents per kilowatt-hour, and also the small extent of the primary rate, covering only 10 kw.-hr. per month at 10 cents per kilowatt-hour—hardly more than enough to recoup the necessary expense of separately metering the load. This represents a very long step in the right direction, for it immediately opens the way not only to the very extensive use of electric-cooking appliances but to a considerable amount of general heating load.

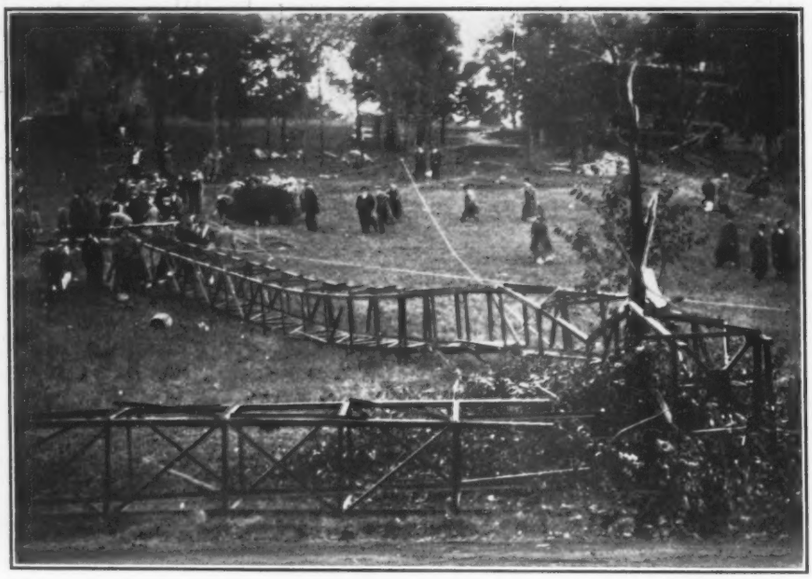
It is a fact of which all of our readers are painfully aware that in every house one or more rooms prove at times difficult to heat by the ordinary domestic appliances, and they are usually uncomfortably cold in the morning when the furnace is not working at its best. Hot-air furnaces are special sinners in the direction of uneven heating, and even steam and hot water are by no means exempt. With the rate such as here mentioned, it becomes feasible to install auxiliary electric heaters quite sufficient to make amply warm the rooms which are now uncomfortable at the expenditure of a very modest amount of energy. A 500-watt heater, running cost practically 1 cent per hour, will take the chill from a bathroom most effectively, and a 1-kw. heater at 2 cents per hour will rob the breakfast room of its shivers. And the beauty of the scheme from the central-station standpoint is that the load thus taken on is from a practical standpoint wholly off-peak, as is indeed most of the cooking load. Long before the peak comes on the furnace is on duty and the need for auxiliary heat is removed.

Few data are at hand regarding the actual amount of energy required for the general heating of a house in various temperate climates. The average American residence is certainly overheated most of the time with its present apparatus, and there is little doubt that in spring and autumn it could be made comfortable by the consumption of a reasonable amount of electrical energy. To heat a house entirely with electricity would, of course, be out of the question throughout the greater part of this country; coal, gas and oil are still too cheap to permit electricity even at very, very low rates to compete—but there is very little doubt that on a 2-cent rate a great deal of auxiliary heating can be done with great advantage and convenience to the consumer.

Electricity as a "Talking Point"

That the non-electrical manufacturer is not always abreast of the possibilities for improving his product offered him by the rapid advance of electricity, and does not always serve his customer's needs as he might, is illustrated in many lines. Small motors for talking machines present no great problem of design or expense, yet the most popular of these machines in all sizes below the few luxurious patterns sold at high prices must be cranked by hand after every few records. Electrically driven piano players of artistic possibilities have lately appeared which, while saving the operator from the need for foot-pumping, leave him free to exercise subtler control of expression and melody. The field of application of electricity in the non-electrical arts is still wide and the sale of such devices will depend in part upon the education of the public in everything electrical.

High Winds Along Atlantic Seaboard Wreck New 300-Ft. Radio Tower



High winds and a sudden drop in temperature were reported general throughout New England and the eastern part of the United States during the first few days of the present week. At New York City the gale reached a measured velocity of 72 miles per hour. Large signs, trees and telegraph poles were blown down here and there, causing minor interruptions to the service of public-utility companies, but little actual damage is reported. At Medford, Mass., however, a new steel tower erected for service at Tufts College by the American Radio & Research Company was blown down across the tracks of the southern division of the Boston & Maine Railroad immediately in front of the White Mountain express, which was approaching at 40 miles per hour. The tower derailed the forward trucks of the locomotive and was virtually torn to pieces. Other portions fell across electric light, power, telephone and trolley wires, also cutting off service for several hours on the local signal and telegraph circuits of the railroad company. The tower was 312 ft. high and had been nearly finished when the accident occurred. It was mounted on a reinforced concrete foundation, and measured 3 ft. 6 in. square, being guyed at 100 ft. intervals by three-strand steel wires, the size at the two lower points of attachment being $\frac{5}{8}$ in. and at the top guying point $\frac{3}{4}$ in. About 500 yd. of overhead lines were torn down when the tower fell, and fragments of the tower were carried 263 ft. by the locomotive.

A Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

Wireless Telephony Across Continent

Announcement has been made at Washington of the successful outcome of experiments which have been carried on for the last few months by the American Telephone & Telegraph Company and the Western Electric Company in co-operation with radio stations under the jurisdiction of the Navy Department by which long-distance wireless telephony has been made possible.

On Wednesday speech was successfully transmitted from the Arlington radio station to the radio station at Mare Island, Cal., and there successfully received, thus making possible conversation without wires over a distance of approximately 2500 miles, the first time this great distance has been covered by wireless telephony.

Conversation originating in New York was transmitted over the land wire to Arlington, there automatically connected to the radio transmitter, which carried the voice to Mare Island, where it was clearly and distinctly received, and answers and other conversation were from there transmitted over the transcontinental line to the originating office in New York.

Speaking of the experiment in San Francisco, J. J. Carty, chief engineer of the American Telephone & Telegraph Company, said:

"Our achievement is fraught with great meaning. It means primarily that the problem of talking across the Atlantic has been solved. It means that before we have finished our labors a man in this city can talk to London or Paris as easily as he now talks to New York.

"We have secretly been trying to telephone by wireless for years. Three years ago we got things to a practical basis, and one year ago we felt that our hopes must soon be realized. On Aug. 27 a secret test was made, and Washington successfully communicated with Darien on the Isthmus of Panama, an approximate distance of 2100 miles. As the messages went via water, they were very clearly heard.

"The feature of our demonstration was that we succeeded despite the great mountains which obstructed the messages and despite the fact that there are unusually powerful disturbances in the atmosphere at this time of year. It is vastly more difficult to traverse land than water, so we are now very sanguine of success in transoceanic wireless telephony."

According to Mr. Carty, the immediate results of the demonstration will be the invention of an apparatus to enable motorboats, yachts and coastwise steamships to converse with the shore or with one another. If conditions in Europe were not so unsettled, he asserted, an immediate effort might be made to bridge the Atlantic.

INTERNATIONAL ENGINEERING CONGRESS

Points Brought Up in Discussions on Subjects Pertaining to the Electrical Industry

The general features of the International Engineering Congress were outlined in the Sept 25 issue of the ELECTRICAL WORLD. In what follows the main points brought up in the discussions during the different sessions that have to do with problems of the electrical industry are given. Fourteen papers were presented at the three electrical engineering sessions held Thursday morning and afternoon and Saturday, Sept. 23 and 25. The subjects taken up Thursday morning were as follows: "Economics of Electric Power-Station Design," by H. F. Parshall, London, England; "The Water-Power of Sweden," by Sven Lubeck, Stockholm, Sweden; "Electric Power in Canadian Industry," by Charles H. Mitchell, Toronto, Canada; "Industrial Effect of Low Cost of Electrical Energy," by L. A. Ferguson, Commonwealth Edison Company of Chicago, and "The Effect of Hydroelectric Power Transmission on Economic and Social Conditions, with Special Reference to the United States of America," by Frank G. Baum, San Francisco, Cal.

Steam-Power-Station Design

An abstract of the paper by Mr. Parshall appeared in last week's issue of the ELECTRICAL WORLD. It took up matters involving the balancing of capital against economies effected by the use of various sizes or types of plant equipment upon which the consumption of fuel depends either directly or indirectly.

In discussing this paper D. B. Rushmore, Schenectady, N. Y., pointed out that the design of a power station should be considered as a plant for manufacturing electricity, with ample provisions for taking advantage of improvements in apparatus and for increasing capacity. He explained that efficiency of apparatus is now approaching limits and that engineering effort in effecting savings is being directed toward the boiler room and transmission and distribution systems. C. R. Weymouth of San Francisco said that the trend of power-plant design on the Pacific Coast is toward higher steam pressures, 250 lb. to 350 lb. and 200 deg. superheat being often used. H. H. Barnes, Jr., of New York City thought that boiler pressures much higher than 250 lb. would be found feasible and economical. It was pointed out, however, that increased steam pressures render the design of turbines and auxiliaries more difficult since the number of blades and stages must be increased and different drives provided for auxiliaries. Rudolph Tschentscher of Chicago complained that papers on this subject have been written from the viewpoint of central-station companies and that industrial establishments of large size should be considered.

Cost of Service to Consumer

In commenting on the paper devoted to marketing of hydroelectric energy in California, during the discussion, John Coffee Hayes of the Mount Whitney Power & Electric Company, Visalia, Cal., emphasized the importance of the commercial department and its ability to secure profitable loads. It is frequently necessary for his company, he said, to advance capital for long periods to customers in an agricultural community by carrying over the bills and taking notes for them. Mr. Hayes does not believe there are many "cheap" hydroelectric power possibilities in California, since it has not been possible to create developments at a cost less than $200 per horsepower, and naturally the cheapest developments have been most attractive. The gross earnings of the California hydroelectric companies, he thought, were less than 25 per cent of the investment and reduced to less than half this on the net income. J. B. Fisken of the Washington Water Power Company, Spokane, Wash., pointed out that the power house ready to operate is only a small part of the system. The cost of supplying power to small customers is largely due to distribution, and until distribution costs can be reduced the small customer may in such cases be supplied at a loss. The cost to power companies may be $1 to $1.25 for the service to small customers, whereas the Washington State Railroad Commission has established a 70-cent minimum rate. About 20,000 customers are being supplied by the Washington Water Power Company, he thought, who could profitably be dropped so far as present revenue from energy consumption is concerned.

At the session on Thursday afternoon the following papers were presented: "Electrical and Mechanical Installations of the Panama Canal," Edward Schildhauer, New York City; "Electric Welding," by C. B. Auel, Pittsburgh, Pa.; "The Application of Electricity to the Heating of Metals," by F. L. Bishop, Pittsburgh, Pa., and "Electric Motors as an Economic Factor in Industrial Life," by David B. Rushmore, Schenectady, N. Y.

The subjects of papers presented at Saturday's session were: "The Influence of the Electric Motor on Machine Tools," by A. L. De Leeuw of Elizabethport, N. J.; "Effects of Electrolysis on Engineering Structures," by Albert F. Ganz of Hoboken, N. J.; "The Mechanical Problem of the Electric Locomotive," by G. M. Eaton, East Pittsburgh, Pa.; "The Production of High Permeability in Iron," by Ernest Wilson, London, England, and "Electric Illumination," by S. H. Blake, Schenectady, N. Y.

In discussing the application of electricity to the heating of metals at the Thursday afternoon session, J. B. Fisken pointed out that mining camps have use for two types of electric furnaces. The muffle furnace has great application on account of its constancy of temperature, while an electric furnace for heating drills would be very superior to the oil furnace as it avoids transporting oil in mountainous districts.

Electric Propulsion of Ships

In discussing the development of turbines at one of the sessions devoted to mechanical engineering subjects, W. J. Davis, Jr., San Francisco, Cal., referred to the use of turbines in battleships to supply energy to motors driving propellers. He stated that the efficiency of the direct-connected generator and turbine is 98 to 98½ per cent in the United States collier Jupiter when the screw speed is 90 r.p.m. The efficiency of the induction motor connected to the screw is 94½ per cent. The efficiency of the drive in a system of this sort is dependent largely upon the propeller speed, and the best plan is to use alternating current with a lower turbine speed. The efficiency of the motor drive for faster screw speed, as in the case of torpedo boats, is about 96 per cent. Mechanical gear reductions even as high as forty to one have proved satisfactory, he said, but it is not considered that the electric drive is applicable to merchant vessels generally, because of the low screw speeds usually used. O. W. Dickie of San Francisco thought that the electric drive would be confined to ships with 5000 hp. or more per shaft. Where a vessel has to do much maneuvering and when an astern turbine is required this detracts much from the advantage.

Purchase or Generation of Electricity for Railroads

In discussing papers on electrification of railways, the question of whether to purchase or generate power and problems of speed changes and regenerative control were among the subjects of debate. George M. Eaton, Pittsburgh, Pa., reviewed the fruitless search thus far for some satisfactory speed-changing scheme for electric locomotives, pointing out the impracticability of various gear systems that have been tried. The mercury-vapor rectifier experiments on the New Haven Railroad had been completed and the equipment is again in the laboratory, he said. This might prove to be an important development, but it is yet too early to predict the outcome in this matter as well as in the case of the split-phase scheme tried on the Norfolk & Western Railroad. As to the source of power, Mr. Eaton pointed out the undesirable nature of the electrified railroad load when a power system carried no other, and he recommended the purchase of power under contract. In reply to this, A. H. Babcock, consulting electrical engineer Southern Pacific Railroad, said that the load-factor for operating trains on mountain divisions would be such that power companies could not handle it, nor could the train schedules be adjusted to make it more favorable, because of the fixed time for moving crops and the congestion on the line in emergencies. On the subject of regeneration, Mr. Babcock said that the value of power thus obtained was negligible as compared with the effective means of braking thus afforded. The advantages are in the elimination of troubles resulting from

overheated brakeshoes and other brake derangements that often lead to derailments. The great percentage of such troubles that occur with ordinary brake systems near the foot of grades emphasizes the desirability of regenerative control.

Underground Conduit Construction

At one of the sessions, when the tearing up of pavements to lay conduits was under discussion, M. M. O'Shaughnessy, city engineer of San Francisco, pointed out the necessity for laws under which public service corporations would be made to conform to reasonable rules. It was mentioned that in a half mile on Broadway in New York City during six months seventy-five holes were made in the pavement. The suggested remedy of using sub-sidewalk space for conduits usually laid in the streets can be applied only in some cities, for in others this space has been appropriated by property owners.

Water-Power Developments

At the mechanical engineering session devoted to waterwheels it was suggested that the fields of civil, mechanical and electrical engineers overlap in hydroelectric power-plant design and construction to such an extent that a committee representative of these branches of engineering could formulate rules of much value. In the discussion on impulse wheels it developed that local conditions govern the question of single-jet or multiple-jet design. The latter permits of lighter castings, but the single jet simplifies control. Sustained efficiency of the waterwheel for a period of years, it was pointed out, should be considered as carefully as first cost. In choosing between impulse and reaction wheels, the clarity of the water should be carefully considered. The efficiency of a turbine runner, W. A. Doble of San Francisco, Cal., who presented the paper on "Waterwheels of the Impulse Type," said, depends first on its design and second upon the quality of the water. In general, the greatest tendency to cut appears in runners of lower specific speed.

At these sessions there was considerable criticism of the federal government's policy in water-power matters. In a paper by William Hood of San Francisco, Cal., on "Electric Motive Power in the Operation of Railroads," it was claimed that national laws are such as to prevent Western railroad companies from considering development of water-power to electrify their lines. In the paper by John D. Galloway of San Francisco, Cal., on "Hydroelectric Power Development and Use," it was stated that a well-defined policy, both State and national, of hampering all initiative in hydraulic development is the only obstacle to the greater use of hydroelectric energy. However, G. H. Marx, professor of mechanical engineering at Stanford University, took exception to this view and expressed the opinion that legislative effort has been necessary solely to protect the public against monopolistic exploitation.

Public Versus Private Ownership of Utilities

On the subject of utilities there was a sharp disagreement with the anti-municipal-ownership views of Dr. A. C. Humphreys of New York. M. M. O'Shaughnessy, city engineer of San Francisco, Mr. Ranson of Mr. O'Shaughnessy's staff, and A. H. Dimock, city engineer of Seattle, contended that, with proper personnel and with the utilities removed from politics, municipal plants can be operated economically and with advantage to the people. Mr. Dimock cited the drop in power rates in Seattle from 20 cents to 6 cents per kw.-hr. as a result of the city's entry into the field. M. H. Brinkley of the California Railroad Commission, also dissenting from Dr. Humphreys' views, declared that cities should be allowed to work out their own problems, adopting municipal ownership if the majority believed it of advantage to the city. He contended that public ownership was the ultimate solution of the utility problem.

Discussion of the papers on technical education presented by Prof. George F. Swain of Harvard and President Ira N. Hollis of Worcester Polytechnic Institute was mainly to the effect that specialization has been carried too far, and that colleges seek rather to give a mass of facts than to develop the thinking power of the students.

STATE CONTROL OF WATER-POWER

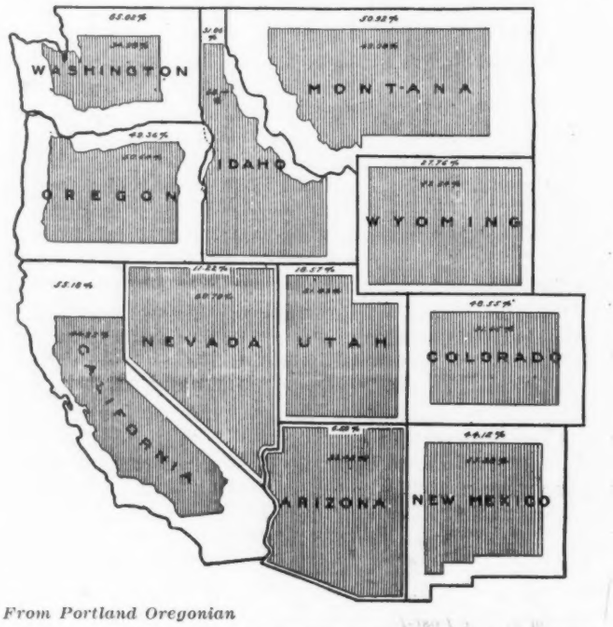
Western States Water Power Conference Urges Recognition by Congress of State Rights in Public Lands

As a result of the Western States Water Power Conference held in Portland last week resolutions were adopted by the delegates on Thursday, Sept. 23, strongly urging the contention of State rights as opposed to governmental control and contending that the Western States are fully capable of dealing with water-power legislation themselves.

The resolution specifically called for a declaration from Congress recognizing and acknowledging that the interest of the United States in the public lands should be subject to the jurisdiction and eminent domain of the States in which the lands are located. It was contended by the delegates that the State ownership of the water was far more valuable than the federal government's ownership of the land, and that the States could handle the situation from that viewpoint.

The conference was the direct result of a resolution passed by the Oregon Legislature in the spring of this year calling for a conference of delegates from Western public-lands States. In consequence, fourteen Western States appointed delegates, and of these fourteen States all but South Dakota and New Mexico were represented at the convention.

The first two days of the conference were spent largely in listening to addresses by well-known officials and utility operators. The position of the government was outlined by Messrs. Tallman, Graves and Merrill, and Senator Chamberlain of Oregon stoutly upheld the merits



From Portland Oregonian

PERCENTAGE OF WESTERN STATES UNDER FEDERAL CONTROL WHICH PAYS NO TAXES

of the Ferris bill. Messrs. Dawson, Piles, Roemer and Ralston spoke in favor of a logical conservation that would permit development of the country's resources on an economical basis.

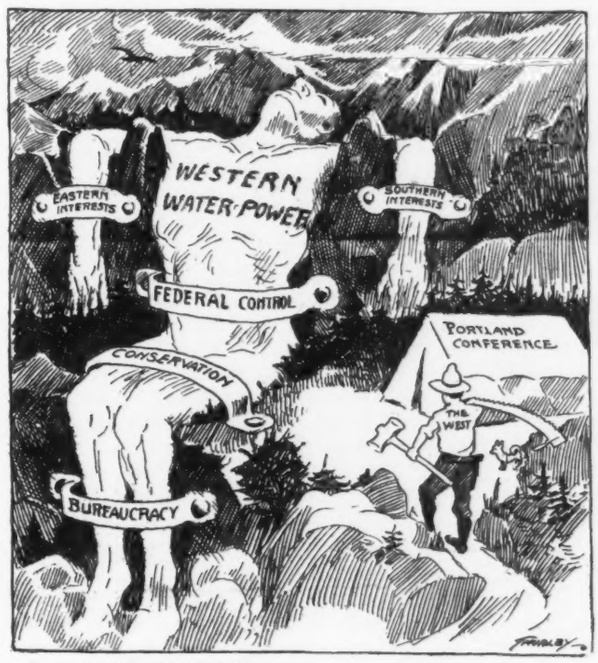
Water-Power Franchises

In discussing the terms of federal water-power franchises John H. Roemer recommended the indeterminate permit with an initial fixed period of fifty years. He suggested that an independent tribunal, such as the Interstate Commerce Commission, be intrusted with the administrative features of such legislation and said:

"The Ferris bill seems to be designed to limit the compensation as nearly as possible to the depreciated value of the physical property, or, as characterized by Justice Lurton in the Omaha water case, the 'bare bones of the plant.' This in most cases would be far from rendering the owner just compensation, and its advocacy is having a baneful influence upon the public utility industries of the country. Those who are endeavoring to have this doctrine prevail as a matter of law in the belief that they are rendering a great public service will, if successful, sooner or later awake to a realization of the fact that men of ability, experience and character who have developed the public-service industries of the country, have made new discoveries and inventions in the arts involved, devised new methods of operation, and, through combination of properties and management, have reduced the cost of service to the benefit of the public, will be either driven out of or voluntarily abandon the field of such industrial activities, allowing it to pass into the hands of a mediocre class, to the great detriment of the public.

"Unless the highest order of technical skill and acumen and organizing financial and executive ability can be attracted to and retained in the industry, little advancement can be expected."

On the floor of the conference Senator Thomas J. Walsh of Montana was the recognized spokesman of the administration, and he strongly assailed the position of the power companies and the opponents of the Ferris bill. Senator Reed Smoot of Utah attacked the Ferris bill, contending that it was an infringement of State rights and that it would be legislation on matters that could be far better handled by the States concerned. There seemed to be a general disposition on the part of the delegates to object to any governmental taxation of water-powers that would result in these being turned into revenue-producing enterprises at the expense of the Western States.



From Seattle Post-Intelligencer

PROMETHEUS BOUND—A WESTERN CONCEPTION OF THE WATER-POWER SITUATION

S. Z. Mitchell, president of the Electric Bond & Share Company, spoke at considerable length against the proposed legislation, contending that it was impracticable and that it would be impossible to finance water-power development under its provisions. Frank H. Short of Fresno, Cal., spoke strongly against the Ferris bill.

The last day of the conference was marked by heated debate between Senators Walsh and Smoot and Clyde C. Dawson, a delegate from Denver. Senator Clarence D. Clark also assailed the Ferris bill in the closing hours of the conference.

Resolution on Water-Power Control

As a result of the conference the following resolutions were passed by a vote of twenty-eight to seven:

"Whereas the new States admitted into the Union are of necessity upon an equal footing in all respects whatever with the original States; and

"Whereas each State has full jurisdiction over all lands within its borders, including the beds of streams and other waters; and

"Whereas the ownership by the federal government of the technical title to vacant public land within a State does not confer upon the federal government any greater or other governmental powers than it possesses within the original States; and

"Whereas the long-established and sound policy of the United States with respect to the disposition of its unappropriated public lands is opposed to the making of a direct revenue therefrom, beyond the expense incident to the surveying, classification and disposing of such lands, but, on the contrary, said policy is intended to encourage and promote the settlement and development thereof, and any act of Congress or any administrative interpretation thereof which is not in harmony with this policy does an injustice to the new States by placing them on an unequal footing with the original States, and by discouraging and preventing the settlement of such new States and the development of their resources; and

"Whereas the vacant land belonging to the federal government constitutes two-thirds of the area of the States represented in this conference and amounts to more than twice the area of the thirteen original States; and

"Whereas the vacant lands belonging to the federal government are under the law exempt from taxation, while the burden of maintaining local government over their entire area rests upon the States; and

"Whereas the maintenance inviolate of the constitutional equality of the States of the Union is essential to that balance of power on which the perfection and endurance of our political fabric depend, and to the harmonious operation of the scheme upon which the Republic was organized; now, therefore, be it

"Resolved, That we are unalterably opposed to any legislation which is in conflict with the fundamental principles above declared.

"Resolved, That the States have the constitutional right and power to control and regulate the appropriation and use of the waters within their boundaries for all beneficial purposes except navigation, and also the right and power to control and regulate the rates and service of their public utilities.

"Resolved, That we are opposed to any policy that looks toward imposing the system of leasing generally upon the public domain, for the reason that such system

is contrary to the spirit of our free institutions and would retard the development of the resources of the States in which there is still any public land.

"Resolved, That in view of what we believe to be administrative misconstruction of existing legislation, we are in favor of a declaratory act by Congress recognizing and acknowledging that the proprietary interest of the United States in the vacant land within the States is subject to the jurisdiction and eminent domain of those States for all uses which are declared by the laws of those States to be public uses and which are essential to the development, well-being and prosperity of those States.

"Resolved, That the purposes of encouraging the development and utilization of the natural resources of the country by private enterprise which actuated Congress in the enactment of the right-of-way acts of July 26, 1866, and March 3, 1891, and in the enactment of the acts of March 3, 1877, and June 4, 1897, making all non-navigable waters on public lands, including forest reservations, free for appropriation for beneficial uses, should actuate Congress to-day in the enactment of any further legislation upon those subjects.

"Resolved, That any legislation by Congress the purpose or effect of which is to substitute arbitrary or discretionary authority of executive officials for the fixed rules of law governing the administration, sale or other disposition of public lands and reservation and rights-of-way over the same will be unwise and inconsistent with the spirit of our Constitution.

"Resolved, That we are opposed to ownership or control either direct or indirect by the United States government of intrastate public utilities."

The dissenting votes were cast by Messrs. Chandler of California, Walsh, Goza and Erickson of Montana, Kearney of Nevada, Hanchett of North Dakota, and Adams of Washington. The other delegates voted in favor of the resolution, with the exception of Governors Alexander of Idaho, Withycombe of Oregon, and Lister of Washington, who were called away from the conference by other duties.

During the conference a banquet was tendered the members by the Portland Chamber of Commerce, at which a series of moving pictures illustrating the necessity of water-power development was presented by Henry J. Pierce of Seattle, and on Friday the delegates were taken over the recently completed Columbia Highway.

Bureau of Standard's Safety Rules

On Oct. 27 the Bureau of Standards will hold a hearing in Washington on its proposed code of safety rules for electrical practice. For two years the Bureau of Standards has been engaged in the study of safety rules to govern the operating practice of employers and employees in electrical work. Meetings have been held in various sections of the country for the purpose of inviting criticism and discussion of the rules, and all of the national electrical engineering societies have been asked to co-operate with the bureau in revising the code.

There is every indication that strenuous objections will be made to certain portions of the proposed code at the forthcoming hearing. The sub-committee of the National Electric Light Association, of which W. H. Blood, Jr., of Boston is chairman, will meet in New York on Oct. 6 to canvass the situation and prepare its case for presentation at the hearing, and the American Electric Railway Association also has a committee busily engaged in formulating its case. Interest in the work of the bureau has increased immensely with the approach of the date of final hearing.

SOUTHEASTERN SECTION, N. E. L. A.

Southern Central-Station Managers Consider at Asheville, N. C., Development of Loads Peculiar to Their Section

The annual convention of the Southeastern Section of the National Electric Light Association was held at the Grove Park Inn, Asheville, N. C., Sept. 22, 23 and 24, with an attendance of 125 members. Among the features of the first session were an address of welcome by Charles D. Waddell, representing Mayor J. E. Rankin; a response by E. C. Deal of Greensboro, N. C.; an address on "Hydroelectric Development—Its Present Potentialities and Its Future Possibilities as Applied to Our Southland," by Capt. W. T. Weaver, president of the North Carolina Electrical Power Company, and President C. M. Benedict's address.

During the second day of the convention three papers were presented—"Sale of Energy to Municipally Owned Distributing Systems of Street Lighting," by W. Rawson Collier of the Georgia Railway & Power Company, Atlanta, Ga.; "A Modern High-Tension System and Its Operation," by W. E. Mitchell of the Alabama Power Company and H. H. Dewey of the General Electric Company, Birmingham, Ala., and "An Accounting Subject," by A. A. Wilbur of the Columbus (Ga.) Power Company.

W. R. Collier's paper contained curves showing the general relations existing between the population of districts and the energy required, maximum power demand, revenue per year, and costs of isolated-plant and central-station energy per 1000 population. Other data were given to show the average unit cost of energy with different yearly load-factors and different annual consumptions.

Available Southern Loads

Seven papers were presented at the last day's sessions—"Electric Power for Driving Textile Mills," by H. A. Orr of the Southern Public Utilities, Anderson, S. C.; "Efficiency in Serving Consumers," by J. M. Mohl, manager of the Cordele (Ga.) Electric Company; "Electric Heating Devices," by W. M. Stearns of the General Electric Company; "Distant-Control Switchboard Design," by Stephen Q. Hayes of the Westinghouse Electric & Manufacturing Company; "Present Assessment Methods for Taxation," by H. H. Carr, general manager Carolina Power & Light Company, Raleigh, N. C.; "Advertising and Its Direct Relation to Central-Station Fields," by J. J. McManus of the General Electric Company, and "Electric Drive in a Cottonseed-Oil Mill," by J. W. Ruff of the Charleston (S. C.) Consolidated Railway & Lighting Company.

H. A. Orr's paper contained reasons why motor drive is particularly desirable in cotton mills.

W. L. Southwell, Macon, Ga., in discussing this paper, declared that the chief arguments in favor of individual drive in cotton mills are increased production and a better product, thereby making the unit cost of production relatively small even if the electrical equipment does cost more. A. M. Schoen of Atlanta, Ga., representing the Southeastern Underwriters, E. C. Deal of Greensboro, N. C., and H. H. Carr of Raleigh, N. C., also took part in the discussion.

In his paper J. M. Mohl explained how customers' complaints and requests should be handled to secure their good will. T. W. Peters of Columbus, Ga., and F. Hammond of Birmingham, Ala., took part in the discussion of this paper.

W. M. Stearns declared in his paper that if proper steps are taken to create a demand for electric-heating devices the energy which will eventually be required for this business will exceed that used for illuminating purposes.

The paper entitled "Electric Drive in a Cottonseed-

Oil Mill" contained descriptions of the hydraulic and cold processes of extracting oil from cottonseed and a mass of valuable tabulated data on the electrical equipment, operating conditions, energy consumption, and unit-production costs for a particular mill.

New Officers

The following officers were elected: President, J. C. Woodsome, Tampa (Fla.) Electric Company; first vice-president, J. H. Plummer, Asheville (N. C.) Power & Light Company; second vice-president, H. A. Orr, Southern Public Utilities Company, Anderson, S. C. The members of the executive committee include J. W. Lindsey, Durham (N. C.) Traction Company; A. Wallace, Columbia (S. C.) Light & Power Company; C. I. Day, Southern Utilities Company, Jacksonville, Fla.; C. D. Flanigen, Athens (Ga.) Railway & Electric Company, and W. E. Mitchell, Alabama Power Company, Birmingham, Ala.

MILESTONES OF ELECTRICAL PROGRESS

A Review of the Chicago Central-Station Situation by Samuel Insull Apropos of the Passing of the Adams Street and Harrison Street Stations

Addressing an audience of about 350 representative electrical men at the Electric Club-Jovian League luncheon of Sept. 23, Samuel Insull, president of the Commonwealth Edison Company, made a brief survey of the central-station situation in Chicago apropos of the public opening of the new Edison Building, the abandonment of the old Edison Building at 120 West Adams Street, and the approaching demolition of the Harrison Street station. Victor H. Tousley, vice-president of the club, introduced Mr. Insull as one who had done more than any other one man in the upbuilding of the electrical industry in Chicago.

A Bit of History

In the original Adams Street station of the Chicago Edison Company at 139 Adams Street (later 120 West Adams Street) the initial equipment of 1888 consisted of four 200-hp. Armington & Sims reciprocating engines, which operated two No. 32 Edison bipolar dynamos with a rating of about 80 kw. each. Thus the largest electric generator on the company's system was at that time rated at 80 kw. To-day the largest generator in use by the Commonwealth Edison Company is at the Northwest station and is rated at 30,000 kw. This shows the amazing increase of 37,000 per cent in size of generating units in twenty-seven years. In the same period of time the total rating of the Chicago central-station system has increased from about 500 kw. to about 350,000 kw.

When the Harrison Street station was put into service in 1894 it was considered one of the most economical producers of electrical energy from steam to be found anywhere. The entire rating of this station when at its maximum was about equal to two-thirds of that of the last turbo-generator installed at the Northwest station. Mr. Insull also spoke of the old South Side generating station at 2640 Wabash Avenue, the old North Side station on North Clark Street, and the Fifty-sixth Street station. These, as well as the Adams and Harrison Street stations, have been practically abandoned as generating stations by the company. All the generating stations of the Chicago surface railways and practically all the generating stations of the elevated railways except one—that of the South Side company at State and Fortieth Streets—have been shut down, energy for railway operation being obtained from the central-station company. Nearly all of the energy produced by the Commonwealth Edison Company is generated in three modern stations—Fisk Street, Quarry Street and Northwest. The oldest of these, Fisk Street station, is but twelve years old. It was probably the first electric generating station in the world to be built exclusively for steam turbines.

Large Output per Capita at Chicago

The speaker then proceeded to give some statistical information. Among other things, he said that the Commonwealth Edison Company has a larger output per capita of the community served than any other central-station company in the world producing electrical energy from steam engines. Further, the energy is sold, on an average, at a lower price than in other cities served from steam-driven stations, while the returns to the owners of the securities are at a satisfactory rate. The company owns about 140 acres of land in Chicago and has about $100,000,000 invested in its business. It is not owned by a few men but has about 3000 stockholders, of whom about 40 per cent are women. It is a home-owned institution, about 72 per cent of the stockholders living in Chicago. Over one-half of the employees are stockholders or are in process of becoming stockholders. About 8 cents of every dollar taken in is held in custody, to be turned over to the authorities in the shape of taxes or municipal compensations.

Considering the lesson to be drawn from central-station progress in Chicago, Mr. Insull said that his company has been built up on the boldly avowed basis of monopoly and that, too, during an era when it was not fashionable to talk about monopoly in this country. The results show that the only way to build up a great public-service business is on the basis of monopoly, thus securing the lowest cost of the product and consequently the lowest price to the consumer. Mr. Insull gave it as his opinion that such a monopoly should be privately owned, for the incentive of private ownership is needed to obtain the best economic results.

Some Predictions for the Future

Glancing at the future, the speaker made some interesting statements. Central-station progress has by no means reached a finality. The introduction of the steam turbine brought about a new era in the electricity-supply business. It is probable that the advances to be made in the future will be greater than those which have been made in the last ten years. Mr. Insull believes that improvements will be made in the steam turbine that will bring about results in lowering cost far beyond anything now achieved. He believes that these results will exceed the economy of the producer-gas engine and be better than the best oil-engine practice of the present day.

It is probable, also, that the area of transmission and distribution from the great central stations of the future will only be limited by density of population. The future will see, no doubt, trunk lines of energy radiating from centers of energy production just as we see trunk lines of transportation radiating from railroad centers to-day. Mr. Insull concluded with an appeal to the younger men to study the development of the electric central-station industry and make it their business to obtain a thorough fundamental knowledge of it. The opportunities for the production and use of electrical energy in the great Mississippi Valley in years to come are almost beyond the scope of the imagination, for electricity must be used in many of the manifold operations of human life.

Prof. P. B. Woodworth of Lewis Institute moved a vote of thanks, which was adopted unanimously, amid hearty applause.

Exchanging Ideas on Illuminating Engineering

BY J. R. CRAVATH

THIS review of the Washington convention of the Illuminating Engineering Society, Sept. 20-23, at the New Willard, does not touch on every paper and every discussion in detail. It presents rather the viewpoint of a man who attended the meetings and took away with him those ideas which are of interest to the man who plans electric lighting, the consulting or sales engineer, the contractor and dealer, and the central-station man.

Semi-direct lighting has been very popular in the last few years, and in so far as it marks a reduction in the brightness or intrinsic brilliancy of the visible sources of light it is to be welcomed as an improvement in the direction of eye comfort and hygiene. However, a majority of the bowls now being sold for this purpose are too bright if we take the various opinions and evidence offered by the best of authorities from time to time in the convention papers and discussions. W. A. Durgin and J. B. Jackson described the model installation of semi-direct lighting in the new office building of the Commonwealth Edison Company, Chicago, in which much care was given to the engineering that it might be right from the hygienic, artistic and efficiency standpoints. The triple-cased glass bowls selected after trials of a number result in an illumination which is about 18 per cent direct and 82 per cent indirect, thus rendering shadows unobjectionable and at the same time cutting down the brightness of the bowl to a safe and comfortable point for continuous work. This brightness is only 90 millilamberts, as against 500 and more for several bowls that were tested. The contrast of bowl and adjacent wall is only 2.6 to 90 and of bowl and darkest ceiling area 1.4 to 90.

Confirming the judgment in this selection was the announced decision of the "glare" committee during the past year to recommend that contrasts of brightness between bowls and their backgrounds be kept within the ratio of 1 to 100 or at most 1 to 200. This was decided upon as a result of a study of all the evidence at hand on interior-lighting conditions giving rise to annoyance or eye fatigue.

Dr. C. E. Ferrée of Bryn Mawr, originator of the now famous Ferrée test for eye fatigue, also presented the results of further investigations along this line in which inverted opal reflectors of different densities were tried for their effect on eye fatigue after three hours' work under each equipment. With reflectors of 128 millilamberts brightness, and a contrast of 1 to 95 between bowl and wall near it, there was markedly less fatigue than with reflectors of lighter density.

It was brought out that bowls of proper size and density are harder to sell than thinner ones that will produce glare. This is partly because low bowl brightness means a larger and more expensive bowl for a given quantity of generated light, partly because the efficiency is somewhat lower with the larger bowl, and partly because the general public and fixture salesmen have not entirely got over judging the advantage of a method of lighting by the relative brightness of the visible source. The brightness of a bowl and its probable ocular effect are matters for test rather than snap judgment. Speaking of efficiency, the Commonwealth Edison installation is remarkedly good in that respect, for a system which is so nearly right from an ocular standpoint, namely, 42.5 per cent with clean bowls and new lamps. The average illumination is 6 ft.-candles on the working plane.

Effect of Dust on Glassware

Service tests on the reduction of illumination caused by the collection of dust on glassware are always of practical value. In the dirtiest location in the Commonwealth Edison offices this was found to be a straight-line depreciation amounting to 25 per cent in three weeks. This is considerably higher than the 11 per cent per month that has been found in some other Chicago office buildings in more favorable locations. This

THE sessions of the convention were divided into general, laboratory and commercial. A few of the points developed in the laboratory and general sessions are presented below:

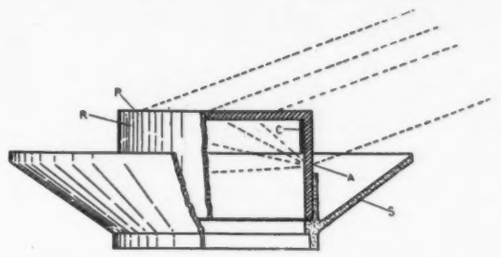
Much discussion revolved around the question, If one has all the light he can use, how much will he use?

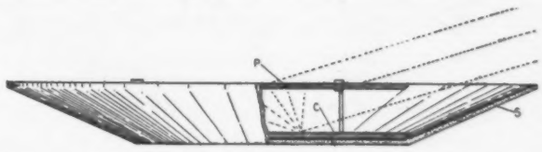
One source of error in portable photometers has always been the white-glass test plate, which does not register full value to light striking it at very oblique angles. Thus, in a test for the quantity of light, or flux, reaching the working plane in a room, this error has usually meant that the results given by the photometer in a system of general lighting would be from 5 to 12 per cent low. While for ordinary comparative purposes this has not been a serious matter, since it affects all test results with a similar form of test plate, nevertheless it is something all would be glad to be rid of. Dr. C. H. Sharp and W. F. Little described a compensating test plate which largely eliminates these errors and in one form allows polished glass (which is easy to keep clean) to be used instead of etched or roughened glass. This is done on the principle of allowing some of the light from very oblique angles to be directed onto the lower side of the plate. The sketches at the top of the opposite page show the plate in its reflecting and transmitting forms.

W. F. Little gave a paper on "Practical Hints on the Use of Portable Photometers," which is of interest to every one operating such instruments but cannot be reviewed in the necessary detail here.

Mechanical and electrical perfection of measuring appliances in the laboratory is bringing about the elimination of clerical work and the checking of figures, with consequent increase in the accuracy of results. The Bureau of Standards has perfected and refined many methods of photometry.

It may pay a large buyer to spend considerable money in testing lamps, in the opinion of Mr. Mees of Rochester, because the cost of testing is not to be compared as a relative expense with the cost of the lamps only. Reliability in service may directly affect the economy of manufacturing operation, and the money spent for insurance of long life may consequently be relatively small in consideration of its influence in holding down the cost of the product.





ABOVE—COMPENSATED REFLECTING TEST PLATE WITH DEPOLISHED WHITE-GLASS TEST PLATE AND DIFFUSER AT LEFT—COMPENSATED TRANSMITTING TEST PLATE OF POLISHED WHITE GLASS, WITH OPAL RING

figure doubtless varies greatly on different floors of the same building.

The contest between various electric lamps for street lighting has apparently for the present narrowed down to the luminous or magnetite arc on the one hand and the gas-filled tungsten lamp on the other. Messrs. Halverson, Rogers and Hussey presented the case for the arc-lamp, and W. H. Rolinson that for the gas-filled tungsten. There are also some notes on this subject in the progress report. The inclosed long-burning flame-arc lamp seems for the present to be out of the running, as it is being replaced in Chicago, where it was installed extensively, with tungsten lamps of less wattage. The situation summed up seems to be that the magnetite arc has a somewhat higher efficiency, especially in the larger sizes as equipped for street illumination, but is not so adaptable to existing series circuits in many places, and unless well maintained may fall farther short of its laboratory performance than the incandescent lamp. The latter is also available in much smaller units for locations where the smallest arc would be unnecessarily large. For the highest class of street lighting where high efficiency in large units is needed the magnetite arc, if well maintained, seems to have the best of it unless problems of electrical distribution and cost of station equipment modify the answer in some particular cases. It was shown that the magnetite arc can be easily altered in luminous output by simply adjusting for longer arc. Thus a 4-amp. lamp will operate anywhere between 65 volts and 90 volts. The Halverson paper gives a table showing the manufacturer's figures from laboratory tests on light output from various kinds of arc lamps. In these the output of the luminous or magnetite arc without glassware is shown to be from 12.7 lumens per watt to 38.5 lumens per watt. When the lamp is equipped with a prismatic refractor, these figures become 10.5 lumens to 23.1 lumens per watt. While no figures were given on the incandescent lamp similarly equipped, its bare output is known to be about 13 lumens to 20 lumens per watt. Operation of incandescent lamps on direct-current magnetite-arc circuits is not recommended at the present time on account of socket cut-out difficulties, but this trouble is likely to be soon overcome. The Halverson paper shows that by the use of a single reflector 25 ft. in diameter or a tri-plane reflector 26 in. in diameter results similar to those with the band-type prismatic refractor could be obtained. The Rolinson paper gives considerable attention to the regulation of series circuits for tungsten lamps. Curves are given showing the relative regulation obtained with a moving-coil regulator or constant-current transformer, the adjuster-socket system, the reactance regulator, and a circuit without a regulator.

Street-Light Engineering Versus Guesswork

It is sometimes said to be an American characteristic to blunder along by expensive cut-and-try methods rather than make use of thorough engineering studies and proceed according to a well-thought-out plan. There are certainly plenty of examples where this has been done. However, the recent Milwaukee street-lighting survey described in a paper by F. A. Vaughn is a pleasing exception to this practice. Milwaukee had an engineering study of street lighting made. The proposed system resulting from this study has a number of interesting features. The lamps proposed are all to be incandescent electric except for the possibility of substituting gas for some of the smaller units. The supply is to be by series circuits supplied from multiple-tap constant-potential transformers at various points on the electric-lighting company's 2200-volt, sixty-cycle primary lines. Each lamp is to have a small individual transformer at the base of the pole, thus making all the pole wiring low-voltage and inexpensive and obviating series cut-outs for the lamps. The street-lighting en-

PAPERS and reports were outlined in the ELECTRICAL WORLD for Sept. 25. Following are ideas developed in the commercial and general sessions:

Small tungsten lamps for 220 volts are now available for marine work. Parabolic reflectors reflecting a parallel beam of light from a small concentrated source render night signaling more secret. Flood-lighting presents possibilities for lighting the coaling of ships.

Ideals of illumination can be approached, if not realized, in each case by the adoption of certain standard fixtures to compete with other forms of illuminants in commercial work. Standardization of fixtures for small stores, for example, makes possible a competitive sales proposition on a price basis. The installation will not be ideal from an illuminating engineering viewpoint, but will be an advance in practice for that store.

For headlights the Pennsylvania Railroad has experimented successfully with a semaphore type of reflector, a glass reflector which throws light practically in a parallel beam and which can be kept clean and so be maintained at a higher relative projecting efficiency in service than a polished parabolic mirror.

General discussion of both sides of the question seems to indicate that in a public utility selling both gas and electricity separate salesmen should be employed for each class of service. This plan has the advantage of any single-purpose idea; it has the disadvantage of losing the opportunity at times to interest the prospective customer in both gas and electricity.

The fixture salesman is the real illuminating engineer in the average case. On him the average householder depends for advice when it comes to putting in new fixtures. Central-station salesmen, it was suggested, could work in certain districts after nightfall. It is then that there is an opportunity to discuss betterments in illumination when the householder can see results.

Flood-lighting of rifle ranges with illuminating fixtures placed behind the marksmen is suggested as a feasible plan.

At the left the photograph illustrates the skyline effect obtained with electric lamps in a banking room.

Tones of gray predominate in the church shown in the central picture, and the lighting was designed to help carry the decorative motif.

In another church, at the right, artificial light has been adapted to bring out architectural details rather than obscure them as sometimes happens in night illumination when this point is forgotten.

Combining the Esthetic and the Utilitarian in Illumination

THE architect finds electric light adaptable for securing esthetic values in effects and impressions as well as for obtaining the purely utilitarian qualities of efficient illumination. This group of pictures, presented through the courtesy of Mr. David Crownfield of Boston, indicates certain of the possibilities of adapting electric lighting for these purposes. Mr. Crownfield's complete paper and his illustrations presented before the Illuminating Engineering Society at its Washington convention were a distinct contribution, not only because of the detail material in the paper, but also for the suggestion it contained, as a whole, of the results which may be obtained when architect and engineer have a common understanding of the lighting of large public and private buildings.

The engineer usually places the emphasis on the efficiency of the light source alone. The architect in his turn thinks of the lighting units as fixtures contributing or detracting as an element in design. Sound illuminating engineering must recognize that the final result is a composite of both viewpoints. When architect and engineer confer the result is usually much better than if each works alone. Esthetic values are matters of personal taste. Utility values can be standardized and measured. Combining both values will improve our public lighting.

Lighting plans in public buildings often give the impression that the idea behind them is to get the maximum amount of metal into the fixtures. The lighting in this hotel, on the contrary, helps to carry out the individuality of the building, combining the ideas of the architect and the engineer.

ergy is to be metered at each constant-potential transformer, where also will be automatic circuit-breakers and a time switch (self-winding), which will turn the circuits on and off at the proper time. It is proposed that the city own the street-lighting equipment up to the point of connection with the company lines. The circuits are to be all underground in steel-taped, lead-covered cable. The annual cost per capita with this proposed system, according to the engineer's estimates, will be about 85 cents, or about the average for American cities, yet the street illumination will be much superior to that which has been common or that previously proposed for the same cost. The city is about to make a start on the new system by equipping a square mile of territory, which will demonstrate whether its lighting performance and costs are correctly stated by the engineers. If the estimates are correct, the city has been well repaid for the engineering study.

Efficiencies in Various-Shaped Rooms

The efficiency of light utilization in some sizes and shapes of rooms has been fairly well established, but there is room for considerable testing on certain other sizes. Some of this missing information, which is very welcome, is supplied by Messrs. Ward Harrison and Earl A. Anderson in their paper "Illuminating Efficiencies as Determined in an Experimental Room." Both the size of the room and the color of the walls and ceiling and floor were varied, and a large amount of data were obtained which are available only by a careful study of the paper. It should be in the hands of every engineer who figures on illumination.

Dark Walls Absorb Much Light

Among the points brought out by the Harrison paper is additional confirmation of the fact that making a ceiling lighter in color increases the light on the working plane in about the same proportion as the reflecting power of the ceiling is increased, while increasing the reflecting power of the walls increases the working plane illumination at a greater rate than the increase in wall-reflecting power.

Bright Versus Dark Surroundings

There have been many discussions and some rather unsatisfactory attempts to determine how bright the surroundings should be for the best conditions of eye work; in other words, to determine whether light-colored or dark-colored walls should be used in offices and libraries. Dr. P. W. Cobb, after several years of investigation, summarized his results in a paper on "Vision and the Brightness of Surroundings," from which it appears that the eye is most sensitive to brightness differences when the test object upon which it is working is of about the same brightness as the surroundings. Dr. P. G. Nutting reported some experiments which indicate that the eye is less sensitive when the field of vision is filled with bright spots and dark shadows.

Opportunities

A. O. Dicker and J. J. Kirk called attention to the numerous opportunities for improved illumination in office buildings. Most of these still have out-of-date equipment. Messrs Durgin and Jackson in their paper already mentioned urged central-station companies to make proper use of their opportunities, now that the production of light has become so cheap, and see that consumers get the quantity and quality of illumination they should have for the best results since they are not tied down by the old limitations. A glaring installation is no longer needed to secure economy.

Eye-Fatigue Tests

The eye-fatigue tests devised and carried out by Dr. C. E. Ferrée and previously mentioned have heretofore been the only method of testing the effect of a period of work under different conditions of illumination. Prof. H. L. Richtmyer and H. L. Howes propose a new method in which the criterion of fatigue is the rapidity of reading backward a given number of words, using certain precautions. This is of practical interest in so far as it means the possibility of another accepted test method that will make easier the determination of what hygienic lighting conditions are.

Yellow Light

M. Luckiesh in a paper on this subject shows the lack of scientific evidence that yellow light is superior to any other from the standpoint of ocular comfort and visual acuity. When it is preferred it is apparently entirely a matter of personal taste, on which there is no room for argument. In this connection it is notable that the Commonwealth Edison building already mentioned has bowls of a distinctly yellow hue, on the theory that this would be more agreeable to a larger number of people than would a whiter color.

Best Light for Photography

Definite answers to the question of the relative value of various illuminants for photography are given in the results of tests at the research laboratory of the Eastman Kodak Company by Messrs. Jones, Hodgsen and Huse. The quartz-mercury arc heads the list in photographic efficiency per watt input. This is followed by the long 16-amp. inclosed carbon arc, the white-flaming carbon arc, the mercury-vapor tube, the magnetite arc and the tungsten lamp in the order named.

Accidents and Light

Industrial accidents are carefully studied by the Travelers' Insurance Company, and R. E. Simpson presented a study of these reports for the year 1910. Of a total of over 91,000 industrial accidents, 10 per cent were due primarily to inadequate illumination, and in 13.9 per cent the lack of proper lighting was the contributory cause. Curves are given showing how the accidents increase during the dark winter months.

ELECTRICAL SUPPLY MANUFACTURERS

Formation of Lamp-Receptacle and Socket Section Approved —Six Other Sections Under Formation

A meeting of the board of governors of the Associated Manufacturers of Electrical Supplies was held at the Biltmore Hotel, New York, on Sept. 9. There was a full attendance, and much interesting and important business was transacted.

The formation of the lamp-receptacle and socket section, a meeting for which purpose was held July 28, was fully approved by the board, and B. E. Salisbury was appointed as permanent chairman by the president, with the approval of the board. A set of rules was also formally approved governing the section, one of which provides that there shall be three standing committees as follows: Key and pull-socket committee, sign-receptacle committee, other sockets and receptacles committee. Each committee will consist of five members, and the chairman of the section will appoint all committees and fill vacancies that may occur. Six or eight other sections in various lines are under formation and will be acted upon in detail at a later meeting.

The president reported having received a communication from the Federal Trade Commission to the effect that work was being done in the development of export business and asking the co-operation of the association. In a canvass of the members all were found favorable, and the Federal Trade Commission was so advised.

THE RELATIONS OF THE CENTRAL STATION WITH ITS PUBLIC ARE EVEN MORE COMPLEX AND DIVERSIFIED THAN THE BUSINESS INTERESTS AND INDUSTRIAL ACTIVITIES OF THE COMMUNITY IT SERVES

Public Relations as Business Assets

A Point of View on the Broad Scope of Public Policy Issues

POLICIES are established within public utility organizations to guide the conduct of the business. Sometimes these policies are developed with a foresightedness that marks them as underlying principles for future generations; sometimes they are set down simply as expedients to meet some immediate problem in a business. Wanamaker's "same-price-to-all" and Marshall Field's "the-customer-is-always-right" policies have a recognized standing in commerce. The obligation to maintain service at any cost is a well-recognized basic public-service policy. A decision to use Western Union one month and Postal Telegraph the next, on the other hand, is an example of a policy fixed to meet a particular condition in one business.

As public utilities have developed, their officers have given an increasing amount of serious consideration to the large matters of policy which in their judgment best conserve their interests.

The Utility Both a Business and a Public Institution

The public utility is not only an ordinary business with many daily vexatious problems to solve, but it is also subject to additional pressure because of its peculiar position as a quasi-public institution. From the nature of the business, public utility managers and directors find themselves the recipients of much unsolicited free advice from outsiders who believe that they know how to run the business. Notwithstanding this gratuitous advice, they carry on a business with customers which in most cases calls for the same display of initiative, energy and judgment as that which marks the successful conduct of any large establishment. As a natural monopoly the public utility has been required to deal with an increasing number of questions which arise from its relations with the public as a community. To steer a course which will save the business from shipwreck becomes more and more difficult. The public has demanded a voice in a business to which it grants the right of monopoly. But the public, at heart fair, cannot feel the individual responsibility of management and take the time, except through its representatives, to understand the necessity for this or that course of action. Under present conditions, therefore, the management of the utility must establish its policies with the business recognition of the needs of a growing enterprise as one factor and, at the same time, with the recognition of the public's right to know the reason for the establishment of such policies.

The Manager Must Take Conditions as He Finds Them

Long ago the public utility managers learned that there is no golden key that will unloose the policies of good management and leave them free to regenerate the business without further direction. They have learned, however, that the conduct of their every-day transactions may have its reaction on the broader policies which have to do with the relations of the company with the public as a community.

The dual relations of the public utility company with the public are set forth on the chart published opposite. The activities of the business as a whole may be divided into two groups—first, those having to do with the public as individuals, and, second, those having to do with the public as a community. The relation of these factors to each other is clear and definite.

Classifying the problems broadly, the chart offers an opportunity of study in a way that will keep in mind the very important bearing that the handling of small matters may have upon the outcome of some vital transaction on which the whole future of the property depends. No company knows, for instance, when the fair treatment of a customer will make a friend who will have a powerful voice in the just settlement of a grave franchise issue. In other words, "public relations" means not only the group of activities which is generally entitled public policy, but also the relations which the company has with its prospective consumers, its consumers and its employees.

The Importance of Everyday Dealings

The public reputation of a company depends so largely on the way in which it handles every-day dealings with individuals that no manager can afford to overlook his responsibilities in this direction. The growing movement within the industry to train employees in serving the public shows the development of the idea that upon the impression left in the transaction of the daily routine depends to a large extent the final outcome of a larger issue. In the personal point of contact between employee and prospective customer the buyer of service or of appliances gets his first impression of the company. A careless or untrained clerk may overthrow the result of a year's expenditure for advertising. The company advertises its desire to please the customer, but a bilious clerk may give the lie to the printed policy.

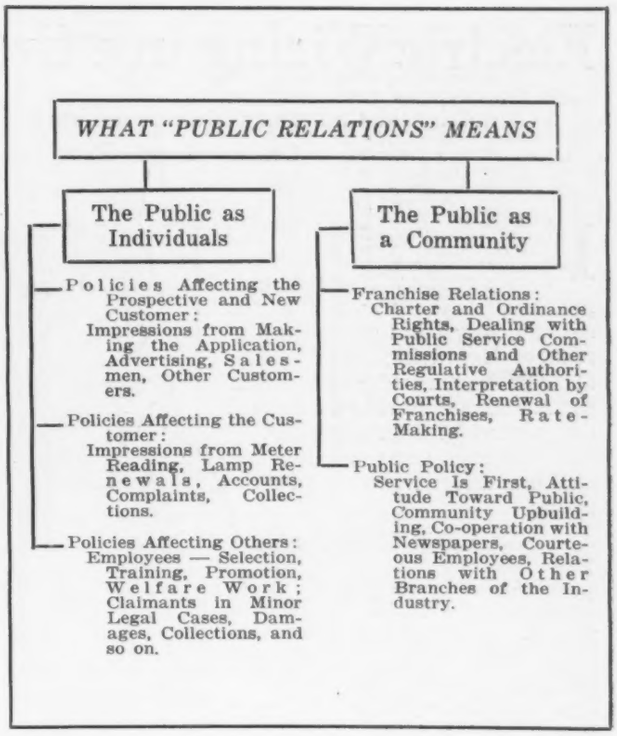
Public opinion may crystallize for or against a company as a summation of individual opinions resulting simply because the individual does not understand. If the public be given an opportunity, it will have a better understanding. The newspapers and the public utility are both interested in the welfare of the community. Since the progress of the public utility means the prog-

ress of the community, the management of the public utility has the opportunity to keep the newspapers informed about its business. A fair policy of co-operation with the newspapers, articles explaining a new development or local enterprise on the part of the company in overcoming some obstacle, for example, will help the development of a better public understanding.

Interpreting Engineering Facts

Managers have found the engineering facts and the final public impressions of these same facts differ greatly. Facts alone, uninterpreted, may confuse rather than clear up a situation. It is unsafe to assume that a mere statement of the facts necessarily means their acceptance by the public. Explanation is necessary. Railroads constantly publish interesting facts about their business. In time-tables and on bills-of-fare in dining-cars the constant explanation of service conditions undoubtedly has helped leading railroad companies in establishing their good reputations as public carriers.

Before the public can be expected to appreciate the interrelations of the many different considerations involved, the understanding and acceptance of them on the part of the companies should be universally recognized. Important as the problems have been in the past, this importance will increase in the future. They demand the best thought and most earnest effort of the industry. Full responsibility for initiative rests with the managers of the public utilities.


WHAT "PUBLIC RELATIONS" MEANS
The Public as Individuals
The Public as a Community
Policies Affecting the Prospective and New Customer: Impressions from Making the Application, Advertising, Salesmen, Other Customers.
Policies Affecting the Customer: Impressions from Meter Reading, Lamp Renewals, Accounts, Complaints, Collections.
Policies Affecting Others: Employees — Selection, Training, Promotion, Welfare Work; Claimants in Minor Legal Cases, Damages, Collections, and so on.
Franchise Relations: Charter and Ordinance Rights, Dealing with Public Service Commissions and Other Regulative Authorities, Interpretation by Courts, Renewal of Franchises, Rate-Making.
Public Policy: Service Is First, Attitude Toward Public, Community Upbuilding, Co-operation with Newspapers, Courteous Employees, Relations with Other Branches of the Industry.

DEPRECIATION IN PUBLIC UTILITIES

Idaho Supreme Court Decides Question May Be Entirely Disregarded if Plant of Utility Company Is in Good Operating Condition

The Supreme Court of Idaho on July 1 handed down a decision involving the question of depreciation as it relates to public utilities. The substance of the decision has just come to hand. In reversing an order of the Public Utilities Commission of Idaho, the Supreme Court said, regarding a deduction by the commission from the value of the property of a water company of so-called "accrued depreciation":

"So far as the question of depreciation is concerned, we think deduction should be made only for actual, tangible depreciation, and not for theoretical depreciation, sometimes called 'accrued depreciation.' In other words, if it be demonstrated that the plant is in good operating condition and giving as good service as a new plant, then the question of depreciation may be entirely disregarded."

The court evidently did not bind itself to follow precedents in the case and was influenced solely by the facts as applied to studies of the subject made by economists. In view of the great importance of a court decision on a matter of such vital interest to the central stations of the country, the following facts are appended:

"Accrued Depreciation" Reaching $77,000

The Idaho Public Utilities Commission, from which an appeal was taken, had before it an application to fix the reasonable rates to be charged by the firm doing business as the Pocatello Water Company. In ascertaining the value of the company's property, the commission deducted more than $77,000 for so-called "accrued depreciation." Public Utilities Commissioner Ramstedt wrote a dissenting opinion, which was practically sustained by the court, in which he said:

"Physical depreciation, resulting from use, decay and the action of the elements, is a constant factor commencing simultaneously with construction and ending with replacement. A person having invested his money in a continuous business enterprise for the benefit of others must always be ready to replace the constructive portions of his plant as they wear out. A person having embarked on such an enterprise is justly entitled to compensation to cover this depreciation in addition to a fair return, over and above expenses, upon the reasonable value of the property. Allowance for depreciation cannot, in my judgment, be considered as profit or an earning factor in the business. The fact that the amount he has received from the public at any time is either greater or less than the amount which he has expended for replacements, if the allowance for depreciation is correctly computed, does not affect the returns to which he is justly entitled on his original investment. He is entitled to a fair return on his investment and to hold the undepreciated property, or its equivalent in value, which he has employed for public use.

Cannot Deduct Depreciation

"The fact that in an investigation of the petitioner's property, undertaken at this particular time, for the purpose of fixing rates, it is found that the market value of his physical property employed for public use has depreciated $77,188.39 does not, in my judgment, justify the commission, in its determination of a fair value for rate purposes, to deduct the amount of depreciation from the present estimated cost of reproducing the property now, and thereby reduce the earning power of his property. The petitioner has undoubtedly in the past twenty years made such replacements from time to time as the public service demanded, and must at all times be prepared to make such replacements as the public service justly demands. I cannot see how we can justly decrease the earning power of his property by decreasing the investment on which he may earn a fair return. Whenever the time comes when any great amount of replacement is necessary, and that may be at any time, he may be required to expend all that he has ever received to cover depreciation, besides a good portion of his earnings."

Electric Wiring in a Great Government Plant—II

Why the Customary Main Switchboard Was Omitted in the Design—Arrangement of Control Board—Provision for Testing Circuit Insulation

BY E. C. STANTON

IN the first installment of this article, published last week, details of the wiring for lighting and motor service in the splendid new building of the Bureau of Engraving and Printing at Washington were given. A further account of the switchboard and control arrangements and of the elements entering into the choice of design now concludes the article.

Design of Electric Installation

The comparative merits of two designs were studied. One design was the customary main switchboard with a feeder to each distribution center. The other design was the omission of a main switchboard and the substitution of a control board with remote-controlled apparatus on the various distribution boards, the feeders taking the most direct route and feeding through one board to another. The latter design was adopted as of equal merit in every respect and superior in many features to the former. It permitted of better control under the conditions, was less expensive to install, required less room where space was small, was better adapted to varying points of service entrance, gave a smaller copper loss, and was of equal reliability.

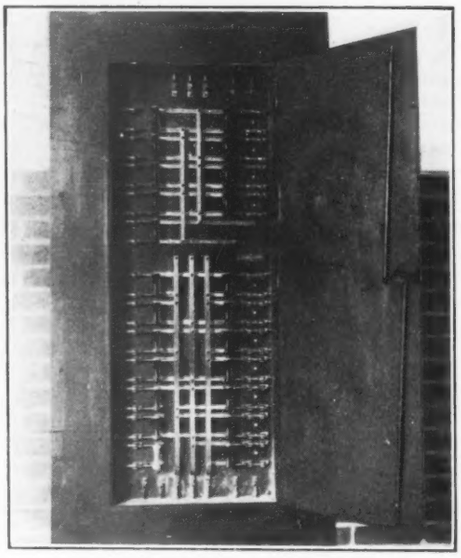


FIG. 8—A TYPICAL CABINET

The design of the motor-service wiring is shown in Fig. 9. The bus feeders extend the full length of the basement corridor, connecting switchboards B-A_1, B-D_1, and junction panels I and II. These bus feeders are of uniform size throughout, and consist of 800,000-circ. mil cables run in steel conduits along the wall of the corridor near the ceiling. The motor-service bus is made up of six pairs of cables in multiple, and the lighting-service bus of two sets of three cables each. Each line in the diagram of Fig. 9 represents a conductor, and the conductors that are run in one conduit are inclosed in circles in enough instances to show the construction. Beyond the bus feeders, the motor-service feeders consist of three pairs of conductors in multiple and the lighting service of one set.

The amount of money available did not permit a duplication of feeders. However, a partial break-down service for the power system was obtained by running all the motor-service feeders with three pairs of conductors in multiple, any two of which will carry the load. This permits repairs to one pair without in any wise crippling the system. Each pair is protected by inclosed fuses on the supply end and reverse-current circuit-breakers at the load end. A connection to intermediate loads is made through fuses (Fig. 10). In the case of a number of presses and other machinery push-button Monitor control is used.

Present service connections are made to the bus feeders at distribution board B-D_1. Provision is also made for a connection either at junction panel I or at board B-A_1, without any changes in the system.

The control board, situated in the engineer's room near the center of the main building, consists of six panels mounted on pipe legs and carries, in addition to the control switches and corresponding indicating lamps, a power-circuit ammeter for each distribution board, two voltmeters, one recording and one indicating, and two lighting-circuit ammeters, one in each outside leg of the main service connection. The ammeters are all external-shunt instruments, the shunts being installed on the various distribution boards, some of which, when measured by way of the leads, are 500 ft. or more distant. One lead of each meter is utilized as a testing wire for making insulation tests of one side of the power branches on the distribution board, as described later. The other side is tested through a red indicating-lamp connection.

The indicating lamps are so arranged that the engineer can tell at a glance whether the circuit-breaker is in or out, and, if out, whether or not it was opened by overload or shunt trip. The connections and operation are shown in the diagram of Fig. 10. When the breaker is closed, no energy will flow through the tripping coil and R, as connections at both ends are negative. The armature of R, therefore, is down, closing the circuit of the green lamp. The red lamp also burns. When the breaker is open, the red lamp is extinguished, while the green lamp may or may not be. If the breaker is opened by the shunt trip, the control switch Op (or the tripping button) is closed, thus energizing the tripping solenoid and at the same time the coil R, which raises its armature, opening the circuit and extinguishing Gp. If the breaker opens on overload, coil R is not subjected to the full line voltage, but is energized partially through the closing relay coil. This partial energization is not sufficient to raise the armature, so the green lamp continues to burn. The adjustment is such that while partial energization of R will not raise its armature it is sufficient to hold it up if raised by other means, so that the lamp remains extinguished when the breaker is opened by the shunt trip after the opening of Op.

For the lighting service only one indicating lamp is provided—a red one—which burns when the distant switch is closed and is out when the switch is open. Its circuit includes the tripping solenoid, but the current taken is too small to trip the switch until the lamp is short-circuited by the closing of the tripping control switch.

The voltmeters are each provided with a four-point switch so connected that the voltage of the motor-service circuit and the voltages between the outside mains or between the neutral and an outside main of the lighting service may be read on either instrument. To secure large-scale readings on the lower voltages, the meters have a nominal rating of 150 volts, and a supplemental resistance is automatically placed in series with the meter when higher voltages are to be read. Two scales

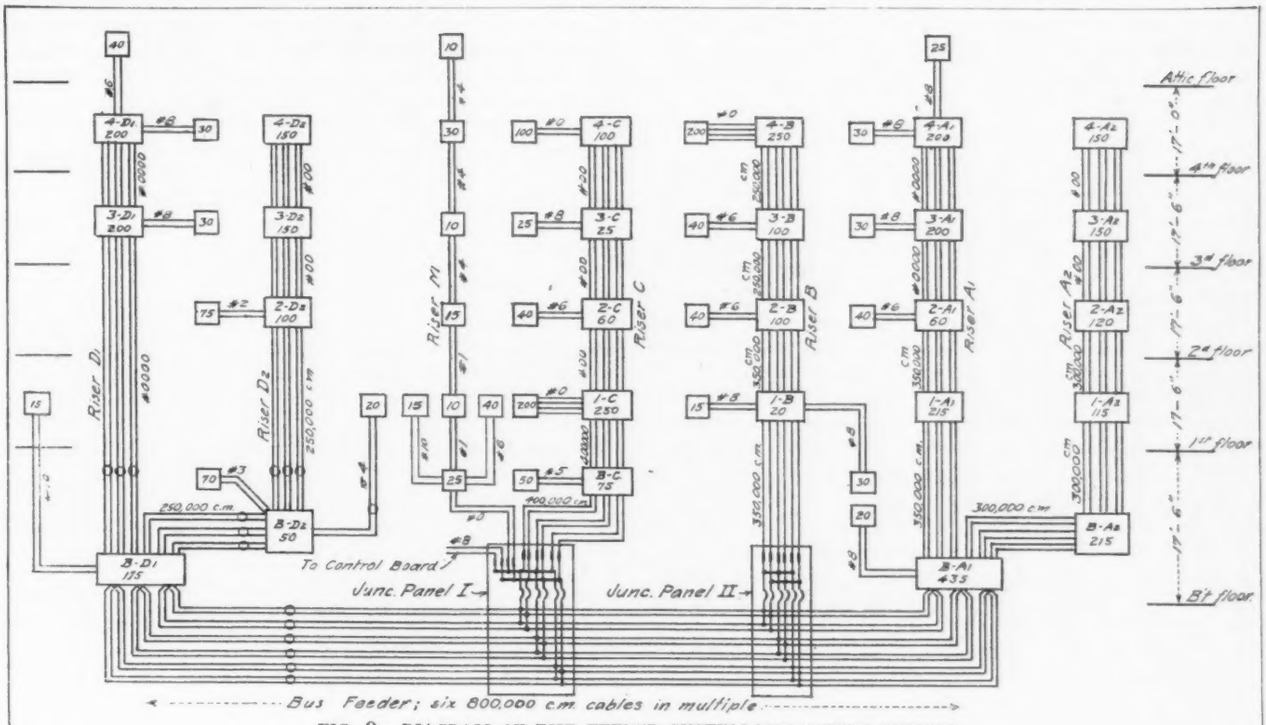


FIG. 9—DIAGRAM OF THE FEEDER SYSTEM FOR MOTOR SERVICE

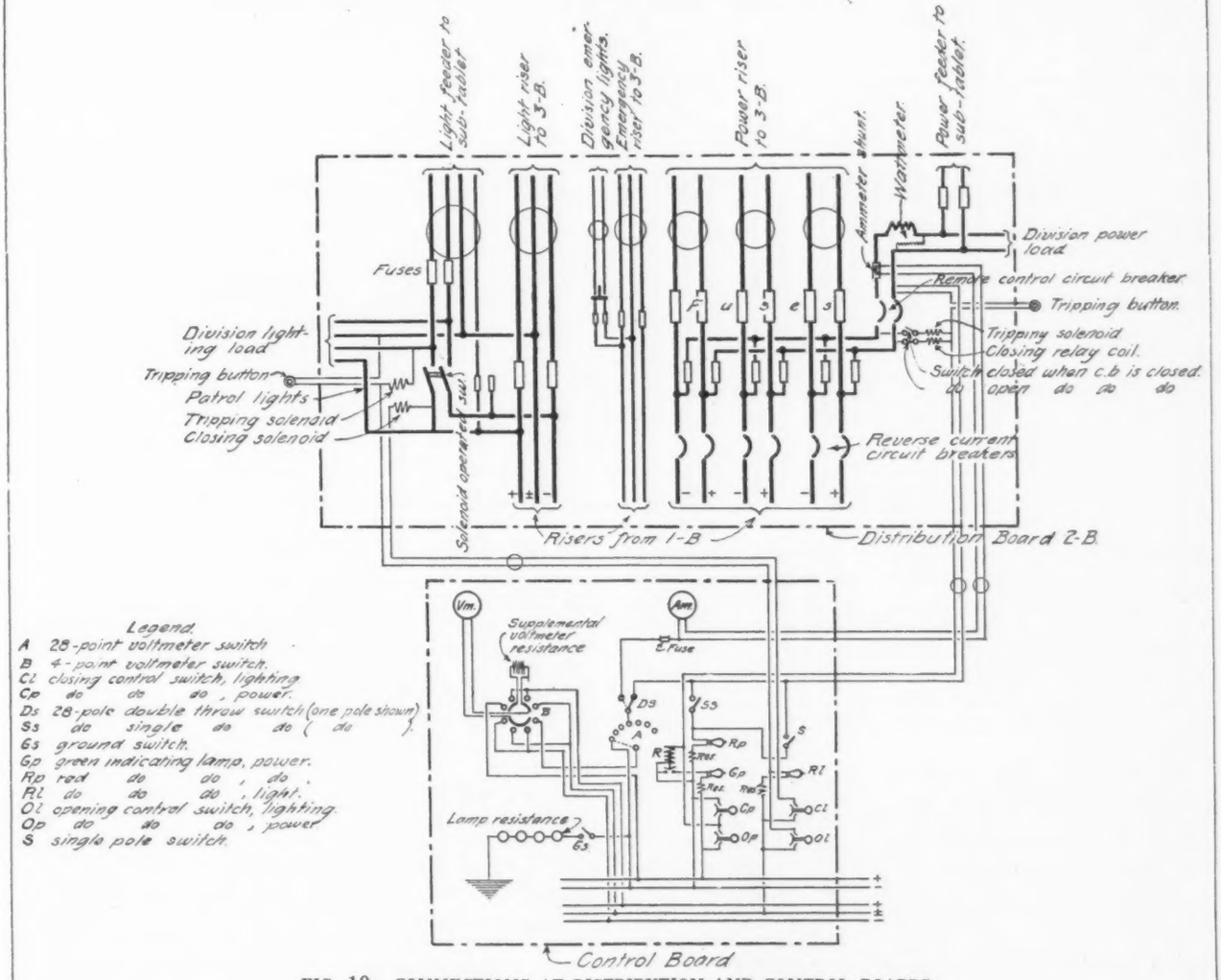


FIG. 10—CONNECTIONS AT DISTRIBUTION AND CONTROL BOARDS

are marked on the meter dials, one for use with the supplemental resistance having scale division numbers which are two times as great as those on the scale for lower voltages.

Provision for Testing Circuit Insulation

In order to detect any weakening of the insulation of the branch-circuit wiring for motor service and to forestall possible break-downs, a method of conveniently measuring the insulation resistance at each distribution board from the control board has been devised. The dial switch *A* (Fig. 10) is provided on its negative side with a button which can be grounded through lamps by closing the switch *Gs* and a button appropriately marked for each distribution board. A button may be connected with one side of the branch-circuit motor-service wiring of the corresponding distribution board through the red indicating-lamp wire, or with the other through the ammeter lead. The change is made collectively by means of a twenty-eight-pole, double-throw switch, one pole of which is shown at *Ds* in the diagram. The indicating lamps are collectively disconnected by means of a twenty-eight-pole, single-throw switch, one pole of which is shown at *Ss*, the switch *S* being normally open. The normal position of the switch *Ds* is open, and that of *Ss* closed. To make a complete insulation test of all the branch motor-service wiring in the building, the attendant sets the four-point voltmeter switch on the points corresponding to the power voltage, and reads the line voltage by turning the dial switch on the negative button, which is grounded by closing switch *Gs*. The switch *Ss* is opened, *Ds* is closed in one direction, and the dial switch run over the buttons, the attendant meanwhile observing the voltmeter needle, which should remain at or near zero. Switch *Ds* is then closed in the other direction and the dial switch again run over the buttons, the voltmeter being observed as before. Should a deflection occur, showing a leak or ground, its location may be determined from the corresponding button and its magnitude computed by the well-known formula,

$$R = r\left(\frac{v}{v'} - 1\right)$$

The voltmeter resistance r is stamped on the nameplate of the instrument. The tests are made with the remote-control breakers open. At the conclusion, the switches *Gs* and *Ds* are opened and *Ss* closed. As it is not necessary for the attendant to move about in performing the necessary test operations, and as the time required for making a test is only a few seconds, it is believed that the tests will be repeated at sufficiently short intervals to lessen materially the probability of delays due to defective wiring or apparatus.

The contract price for the electrical work was $65,000, and, together with the heating, plumbing and ventilating systems, was installed by the Thompson-Starrett Company, New York City, under the direct supervision of the supervising architect of the Treasury Department. The entire work was completed about May 1, 1914, although the building had been used in part for more than two months previous to its completion.

The Cost per Pound of Electrical Machinery

By LEONARD A. DOGGETT

W. S. Murray was once asked how much electric locomotives cost. His reply was that such locomotives cost about as much per pound as turkey, i. e., 18 cents. This article aims to give a partial answer to the question, How much does electrical machinery cost per pound?

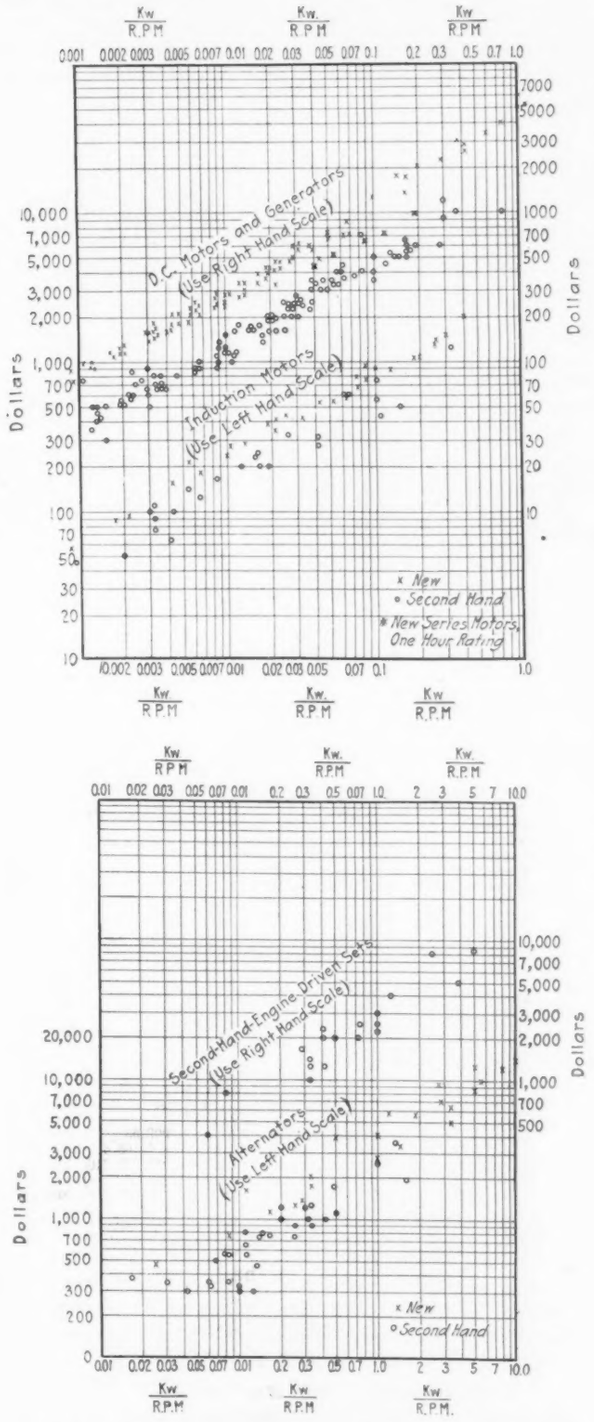
THE cost of any article is not as a rule a fixed quantity, but varies more or less widely. It varies with the prosperity of the country, it varies with the business relations between the customer and manufacturer, it varies with the size of the order, it varies with the reputation of the manufacturer, it varies with the newness of the machine, and, of course, with the many elements entering into the original manufacturing cost.

All these variables render any accurate estimate impossible. The best that can be done is to set limits within which the cost figure will lie. Of course, to a certain limited number in the offices of the manufacturing companies, accurate information is available, but such data are not generally accessible. However, there are other sources of information which serve to indicate the limits of the cost figure. The figures given below are based upon (1) a paper entitled "Prime Movers," by H. G. Stott, R. J. S. Pigott and W. S. Gorsuch (*Proceedings, A. I. E. E.*, June, 1914); (2) cost figures for a recent line of direct-current machines of one of the largest manufacturing companies, the prices being those offered to a small contractor by a local office of this company; (3) cost data in Pender's "American Handbook for Electrical Engineers"; (4) miscellaneous data gathered by the writer within the last two years; (5) data on second-hand machines as published in the "Searchlight Section" of the ELECTRICAL WORLD and in the "Curb Market" of the *Electric Journal*.

It is a well-known fact that a 1-hp. motor having a rated speed of 2000 r.p.m. is much cheaper than, and about one-half as heavy as, a 1-hp. motor having a rated speed of 1000 r.p.m. Therefore, the rational way to tabulate either cost or weight data is in terms, not of dollars or pounds per kilowatt, but of dollars or pounds versus kilowatts divided by speed. The term (kw. ÷ r.p.m.) is really torque, and of any machine it can be said that the greater the torque the greater the necessary size, weight and cost. Therefore, in this pa-

per the independent variable is taken as (kw. ÷ r.p.m.). In Figs. 1 and 2 the accumulated data are plotted.

From these curves Table I has been prepared, showing the average cost in dollars at various values of kw. ÷ r.p.m. From some weight data published by the author in the ELECTRICAL WORLD for May 3, 1913, Table


Kw. / R.P.M.
Dollars
D.C. Motors and Generators (Use Right Hand Scale)
Induction Motors (Use Left Hand Scale)
× New
○ Second Hand
* New Series Motors, One Hour Rating
Second-Hand-Engine Driven Sets (Use Right Hand Scale)
Alternators (Use Left Hand Scale)

FIGS. 1 AND 2—CHARTS PLOTTING COST DATA FOR ELECTRICAL MACHINERY

II was obtained. Table III is obtained from Tables I and II.

From curves, such as Figs. 1 and 2, it is possible to obtain formulas which will represent the average result in a compact form and also be serviceable for a certain amount of extrapolation. For example:

Name of Machine	Cost in Dollars
New direct-current generators and motors	$4{,}500\left(\frac{\text{Kw.}}{\text{R.p.m.}}\right)^{.06}$
Second-hand direct-current generators and motors	$1{,}800\left(\frac{\text{Kw.}}{\text{R.p.m.}}\right)^{.08}$
3600-r.p.m. turbo-alternator sets	$33{,}500\left(\frac{\text{Kw.}}{\text{R.p.m.}}\right)^{.0769}$
1800-r.p.m. turbo-alternator sets	$29{,}500\left(\frac{\text{Kw.}}{\text{R.p.m.}}\right)^{.0833}$

However, the curves present the information in the best form, for the limits between which the cost of a machine lies can easily be seen. In using Figs. 1 and 2 it should be remembered in the case of new machinery that these figures represent standard or stock machines,

TABLE I—COST IN DOLLARS

Name of Machine	New or Second-Hand	Kw. ÷ R.P.M.				
		0.001	0.01	0.1	1.0	10.0
Direct-current generators and motors	New	85	280	1,150	5,500	....
Induction motors	New	100	260	850	3,500	....
Alternators	New	.....	.....	1,200	4,600	16,000
Turbo-alternators	New	.....	.....	.....	37,000	136,000
Low-speed engines	New	Com pound		.....	6,000	17,700
High-speed engines	New	Com pound		1,600	4,900	.....
Low-speed engines	New	Sim ple		.....	3,200	13,500
High-speed engines	New	Sim ple		680	2,530	.....
Direct-current generators and motors	Second-hand	40	120	450	1,600	.....
Induction motors	Second-hand	45	170	550	2,500	.....
Alternators	Second-hand	...	140	450	2,200	8,000
Engine-driven direct-current and alternating-current generators	Second-hand	.....	200	700	3,000	13,000

TABLE II—WEIGHT IN POUNDS

Name of Machine	Kw. ÷ R.P.M.				
	0.001	0.01	0.1	1.0	10.0
Direct-current generators and motors	130	810	4,200	22,000	110,000
Induction motors	80	510	2,800	15,000	81,000
Alternators	130	810	4,200	20,000	90,000
Turbo-alternators	.....	.....	.....	170,000	640,000
Low-speed engines	.....	.....	2,400	19,000	140,000
High-speed engines	.....	.....	4,500	31,000	.....
Engine-driven direct-current and alternating-current generators	.....	1,400	8,000	50,000	250,000

TABLE III—CENTS PER POUND

Name of Machine	New or Second-Hand	Kw. ÷ R.P.M.				
		0.001	0.01	0.1	1.0	10.0
Direct-current generators and motors	New	65	35	27	25	..
Induction motors	New	125	51	30	23	..
Alternators	New	...	..	29	23	18
Turbo-alternators	New	...	..	..	22	21
Low-speed engines	New	Com pound		..	28	11
High-speed engines	New	Com pound		36	15	..
Low-speed engines	New	Sim ple		..	17	9
High-speed engines	New	Sim ple		15	8	..
Direct-current generators and motors	Second-hand	31	15	11	7	..
Induction motors	Second-hand	56	33	20	17	..
Alternators	Second-hand	...	17	11	11	9
Engine-driven direct-current and alternating-current generators	Second-hand	...	14	9	6	5

and that machines with unusual specifications will lie above any data there plotted. In gathering and plotting the information interesting facts developed, many of which could be explained. For example, cost figures on Edison bipolars, Stanley inductor alternators and 133-cycle alternators, if they had been plotted, would always have fallen below the general trend of the plotted points. That is, obsolete types of machines lie between the curve for second-hand machines and the scrap value of the machine, In Fig. 1 are plotted some data on new one-hour-rating series motors, these points being represented by #. As would be expected, these points lie between the points for new and those for second-hand direct-current machines.

It is interesting to note that the average cost of all the new machinery tabulated is 32 cents per pound, and of the second-hand machinery 17 cents per pound, representing a depreciation of machinery which is second-hand but not obsolete of about 50 per cent. Some dealers specifically advertise used machines at 40 per cent of the new price, so that 40 to 50 per cent may be taken as a reasonable figure.

Substantial Growth in the Central-Station Field

End of First Year of the European War Finds Light and Power Companies in Nearly All Parts of the Country Again Growing at Normal Rate

THE results of the July operations of the electric light and power companies of this country according to the returns received by the ELECTRICAL WORLD, show increases over July, 1914, of 6.6 per cent in gross operating revenue and 9.9 per cent in kilowatt-hour output. While both of these figures are slightly less than the June figures, they are sufficiently close to indicate that the high percentages of June in the growth of the light and power industry had again reached the plane of activity in normal times.

In both of the Eastern groups, New England and the Atlantic States, the percentage increases for July, 1915, were less than for June, while in the Far West and Middle West the growth percentages continued to increase. An increased demand for zinc has caused the companies supplying zinc mines to increase largely a load which is very profitable. Several companies in the zinc-mining region have felt the necessity of increasing their equipment capacity.

Increased Industrial Load

In all sections of the country there is one particularly noticeable feature, namely, the increased industrial load. Some of it is that of industries newly

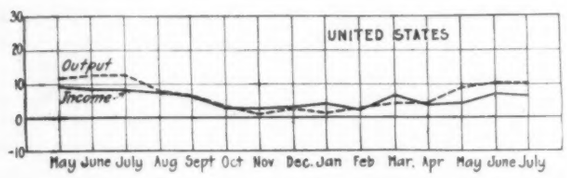


FIG. 1—CENTRAL-STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

equipped for electricity, some that of industries which have already been equipped and have greatly increased their demand. Much of this is due to war orders, but just how much is not known. It is known, however, that plants all over the country manufacturing boots, shoes, cotton and woolen goods, ammunition, tools, automobiles, guns and other war accessories are utilizing central-station energy. The number of companies reporting losses due to the "jitney" invasion is growing less and less. It must also be remembered that to a certain very appreciable extent these returns are affected by rate reductions. At the same time, the improvements of the incandescent lamps have caused a marked decrease in consumption of energy per customer for lighting, which is the largest source of revenue of the light and power companies. The carbon-filament lamps with a rating of 3 watts per candle-power have been and are still being replaced by tungsten lamps which in the same time consume but one-third the energy consumed by carbon lamps of the same candle-power. Also, the new gas-filled lamps with ratings in the neighborhood of 0.5 watt per candle-power for large sizes are replacing older types of electric lamps for street lighting. On the other hand, the new business which a lower schedule of rates and the introduction of lamps with a lower energy consumption will place on service lines tends in a measure to offset these reductions in output and income.

It is interesting to note that the July figures for companies operating in cities with between 50,000 and 100,000 inhabitants are almost invariably better than the June figures so far as growth percentages are concerned. On the other hand, companies operating in cities with more than 100,000 population show smaller percentages of growth in July than in June.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
1914							
Aug..	51	$15,298,226	$14,200,649	7.8	778,109,565	718,274,456	8.2
Sept..	51	15,708,695	14,694,205	7.0	782,450,267	733,754,420	6.8
Oct..	59	17,667,912	17,174,567	2.8	969,817,024	935,249,519	3.0
Nov..	65	19,777,650	19,260,451	2.7	986,456,324	978,934,946	0.8
Dec..	65	20,978,430	20,281,812	3.3	1,074,083,543	1,043,457,795	3.0
1915		1915	1914		1915	1914	
Jan..	65	21,582,547	20,697,423	4.1	980,085,036	966,200,323	1.4
Feb..	63	19,395,518	19,023,107	2.0	853,817,221	835,288,039	2.2
Mar..	64	18,654,443	17,529,054	6.4	939,117,179	896,903,968	4.8
April.	65	18,406,412	17,675,784	4.2	900,536,022	859,235,144	4.8
May.	65	17,467,581	16,601,456	5.2	914,768,458	838,490,437	9.0
June.	65	17,414,009	16,304,317	6.9	918,917,710	832,152,235	10.4
July..	63	16,158,760	15,157,264	6.6	885,053,016	804,890,064	9.9

Results of First Year of War

With July ended the first twelve months of the European war. To what extent it has affected the light and power industry can be seen from the accompanying figures. During this twelve months' period the average growth in income was 4.9 per cent and in output 5.2 per cent over the preceding year. For the three months immediately preceding the war the average rate of increase compared with May, June and July of 1914 was 8.8 per cent in income and 12.8 per cent in output.

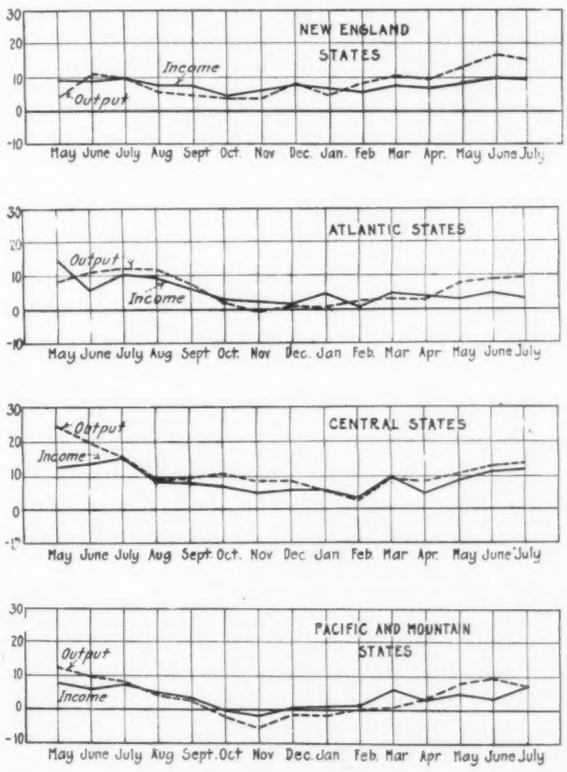
During the first half year of the war the increase

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States		Per Cent Increase	Percentage of Industry Represented	Atlantic States		Per Cent Increase	Percentage of Industry Represented	Central States (Illinois Excluded)		Per Cent Increase	Percentage of Industry Represented	Pacific and Mountain States		Per Cent Increase
			1914	1913			1914	1913			1914	1913			1914	1913	
INCOME	Aug.	61	$1,734,583	$1,607,649	7.5	55	$6,224,896	$5,755,515	8.2	57	$4,389,696	$4,051,678	8.4	75	$2,386,677	$2,282,061	4.6
	Sept.	61	1,766,587	1,647,945	7.3	55	6,608,221	6,221,000	6.1	57	4,704,780	4,368,251	7.9	75	2,487,513	2,398,176	3.7
	Oct.	64	1,963,579	1,889,255	4.0	67	7,451,220	7,232,063	3.1	57	5,105,810	4,783,847	6.8	85	3,146,160	3,157,689	0.3*
	Nov.	67	2,229,742	2,115,957	5.6	69	8,373,772	8,157,966	2.7	57	5,408,672	5,158,981	4.8	88	3,503,499	3,574,086	2.0*
	Dec.	67	2,385,711	2,218,387	7.5	69	8,765,275	8,594,773	2.2	57	5,992,542	5,654,740	5.9	88	3,834,902	3,813,912	0.3
			1915	1914			1915	1914			1915	1914			1915	1914	
	Jan.	67	2,423,795	2,271,881	6.8	69	9,075,335	8,695,593	4.4	57	5,827,997	5,525,579	5.4	88	3,960,608	3,917,371	1.0
	Feb.	67	2,246,794	2,134,341	5.4	69	8,037,878	7,968,625	0.9	55	5,296,786	5,148,439	3.0	85	3,576,432	3,534,864	1.2
	March	67	2,146,032	1,999,326	7.5	69	7,777,126	7,419,808	5.2	55	4,885,384	4,465,728	9.5	88	3,605,893	3,412,842	5.8
	April	67	2,109,767	1,976,473	6.8	69	7,510,810	7,241,164	3.9	57	5,003,673	4,773,949	4.8	88	3,475,740	3,366,830	3.2
	May	67	2,035,680	1,887,606	7.9	69	7,100,334	6,912,581	2.6	57	4,770,283	4,414,728	8.3	88	3,383,749	3,233,989	4.8
	June	67	2,053,065	1,865,687	10.2	69	6,945,986	6,628,523	4.8	57	4,814,161	4,329,361	11.2	88	3,409,738	3,281,696	3.9
	July	60	1,744,903	1,601,287	9.1	68	6,502,346	6,322,560	2.7	57	4,443,966	3,979,256	11.7	88	3,305,598	3,085,146	7.2
KW.-HR. OUTPUT	Aug.	61	55,801,224	52,913,483	5.4	55	264,717,319	237,984,895	11.2	57	267,501,400	226,276,638	9.4	75	193,216,699	185,330,705	4.2
	Sept.	61	55,525,272	53,267,877	4.3	55	270,974,533	252,648,550	7.3	57	260,705,339	237,832,934	9.7	75	190,979,705	185,090,658	3.2
	Oct.	64	67,520,070	65,068,938	3.8	67	358,458,539	351,362,247	2.1	57	295,490,712	266,827,567	10.5	85	245,966,868	252,047,828	2.4*
	Nov.	67	69,480,163	66,988,456	3.8	69	361,364,405	364,155,759	0.7*	57	290,681,750	269,220,528	8.0	88	255,651,947	269,467,354	5.1*
	Dec.	67	78,510,793	71,990,132	7.8	69	401,623,514	396,251,867	1.2	57	315,027,232	291,511,670	8.0	88	278,922,004	283,704,076	1.6*
			1915	1914			1915	1914			1915	1914			1915	1914	
	Jan.	67	72,550,608	69,317,803	4.7	69	374,972,536	373,336,906	0.7	57	272,623,760	258,572,903	5.5	88	252,531,483	256,198,272	1.4*
	Feb.	67	66,600,132	61,515,979	8.3	69	312,443,505	305,307,260	2.4	55	238,938,034	232,520,476	2.7	85	229,865,568	229,185,967	0.3
	March	67	72,121,319	65,343,335	10.5	69	346,341,496	335,506,429	3.3	55	257,136,231	235,656,647	9.2	88	255,529,704	253,423,951	1.0
	April	67	68,475,232	62,442,110	9.7	69	320,142,323	311,476,008	3.0	57	257,967,434	237,673,326	8.5	88	246,287,781	239,661,364	2.8
	May	67	68,823,914	61,060,621	12.9	69	326,191,569	301,440,779	8.1	57	256,758,177	232,258,318	10.6	88	254,586,394	236,082,868	7.8
	June	67	71,300,672	60,771,719	16.3	69	318,245,370	293,751,083	8.5	57	260,046,168	230,347,159	12.8	88	261,083,835	237,843,021	9.8
	July	60	57,284,735	49,798,193	15.0	68	312,118,409	286,115,893	9.0	57	253,859,746	223,900,860	13.3	88	254,340,034	237,249,604	7.2

*Decrease.

in income compared with the corresponding six months of the previous year was 4.6 per cent and that in output was 4.0 per cent. In the second six months of the war these percentages of growth had increased to 5.1 per cent in income and 6.9 per cent in output. A further separation of the first year of the war into quarters shows the following percentage growth over the corresponding period one year previous: First quarter—income 5.9 per cent, output 6.3 per cent; second quarter—income 3.4 per cent, output 2 per cent; third quarter—income 4 per cent, output 3.9 per cent; fourth quarter—income 6.3 per cent, output 9.8 per cent.



FIGS. 2 TO 5—CENTRAL-STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

The full effect of the war on the industry, it is seen, was therefore not instantaneous, but was most strongly felt about half a year after the beginning of hostilities. Since then, however, the percentages of growth, instead of falling off, have become larger. However, it must not be forgotten that at no time have the total gross earnings of the electric light and power industry fallen below the mark set in the previous year, but on the other hand the returns of every month have shown a substantial increase. Using our figures as indicative of the entire industry, it is estimated that the gain in gross operating revenue for the entire industry was in the neighborhood of $16,500,000, while the output had increased by 896,000,000 kw.-hr.

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED ACCORDING TO SIZE

	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July
INCOME:									
Group 1	2.6	0.6	2.7	2.0	8.0	3.8	4.8	6.3	5.3
Group 2	4.7	0.9	8.8	3.7	6.9	5.0	6.2	2.8	9.5
Group 3	0.5	3.3	2.4	2.5	5.2	5.5	5.8	10.0	9.8
Group 4	4.8	4.8	5.8	6.8	5.0	3.9	7.1	6.9	9.0
Group 5	1.5	3.2	4.5	0.9	1.6*	1.9	5.5	4.7	6.7
OUTPUT:									
Group 1	0.5	3.1	3.9	2.8	5.7	5.4	7.2	10.0	8.8
Group 2	4.2	3.0	4.3	5.7	7.9	11.2	13.1	9.1	19.6
Group 3	7.2*	6.8	1.2	3.9*	3.6*	1.2*	6.1	11.2	4.5
Group 4	5.7	9.2	9.0	5.5	3.2	3.0	29.1	6.0	5.9
Group 5	2.6*	1.8	7.5	15.0	7.0	5.9	15.5	14.8	22.8

*Decrease.

During the first year of the war the average percentage rate of increase in New England was 6.8 in income and 8.2 in output, as compared with the 8.5 per cent in income and 8.1 per cent in output during the preceding three months, when conditions were normal. It is interesting to note that the average rate of growth

in output in New England during the twelve months of the war was 0.1 per cent greater than during the average of the quarter preceding the war. The average rate of increase in the Atlantic States was 4.8 per cent in income and 4.6 per cent in output during the twelve months, as compared with 11.3 per cent in income and 10.5 per cent in output during May, June and July, 1914. In the Central States the average rate of increase during the first year of the war was 6.6 per cent in income and 9.7 per cent in output, as compared with 13.7 per cent in income and 19.8 per cent in output during the three preceding months. In the Pacific and Mountain States the percentages of increase for the first twelve months of war were 1.7 per cent in income and 1.5 per cent in output, as compared with 6.6 per cent in income and 9.6 per cent in output, the rates of increase attained during May, June and July, 1914.

The accompanying curves show graphically the monthly percentage increases contained in Tables I and II. The remaining tables show the percentage increases both in income and output for cities grouped according to size. Group No. 1 includes cities whose population is over 100,000; group 2, those cities having a population between 50,000 and 100,000; group 3, those between 25,000 and 50,000; group 4, those between 10,000 and 25,000; group 5, those between 5000 and 10,000.

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July
INCOME:									
Group 1....	6.1	7.9	7.1	5.7	6.6	6 3	9.4	11.6	9.1
Group 2....	2.3	5.5	6.2	4.1	9.0	4.04	7.5	7.0	9.1
Group 3....	9.7	11.4	7.5	0.7	7.8	20.6	8.9	21.8	10.8
Group 4....	9.0	8.2	8.9	9.4	6.5	8.4	7.1	10.0	5.9
Group 5....	3.9	5.5	2.1*	1.9	14.7*	0.4*	1.0*	2.8	11.6
OUTPUT:									
Group 1....	6.9	12.5	6.3	11.1	12.0	12.7	16.0	19.0	11.8
Group 2....	1.5*	5.9	5.4	6.4	12.3	12.3	19.9	20.8	27.0
Group 3....	7.5	11.0	1.2	3.6*	0.3*	3.2	7.0	17.9	19.5
Group 4....	4.2	12.5	10.9*	9.4	12.5	12.1	6.3	14.0	6.2
Group 5....	8.3*	4.1	9.0*	6.1	29.8*	25.5*	13.5*	1.0	12.7

*Decrease.

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED ACCORDING TO SIZE

	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July
INCOME:									
Group 1....	3.0	1.6	1.3	1.3	4.7	1.6	2.0	3.8	1.4
Group 2....	2.7	3.9	5.0	4.2	7.1	5.6	8.2	8.0	12.7
Group 3....	0.3*	0.4	3.3	3.6	3.8	4.1	1.6	7.5	7.5
Group 4....	4.8	7.9	4.9	10.1	6.8	2.9	6.2	3.9	5.6
Group 5....	13.5	11.2	9.0	†	†	15.2	19.6	14.8	†
OUTPUT:									
Group 1....	0.0	3.2	1.7	3.0	6.1	4.8	9.0	8.2	8.0
Group 2....	5.0	4.3	3.1	7.0	9.7	7.6	7.1	11.0	15.0
Group 3....	8.5*	7.7*	7.4	2.7*	8.5*	4.1*	3.2	7.2	7.5
Group 4....	3.8	6.2	7.8	6.3	10.2	1.9	22.5	7.1	13.2
Group 5....	57.5	11.1	13.5	†	†	57.2	71.5	61.8	†

*Decrease. †Results omitted owing to insufficient returns.

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED ACCORDING TO SIZE

	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July
INCOME:									
Group 1....	4.7	5.2	6.1	3.5	10.1	7.3	9.8	11.7	11.9
Group 2....	5.2	7.5	4.3	1.4	5.9	3.5	3.0	5.6	7.2
Group 3....	4.0	7.5	2.1	6.2	11.3	10.4	15.5	19.6	16.4
Group 4....	4.3	6.4	3.6	6.0	8.3	6.0	6.7	12.4	13.6
Group 5....	0.5*	1.5*	3.7	2.8	7.7	7.6	19.9	5.0	1.2
OUTPUT:									
Group 1....	2.4	4.2	9.0	4.7	7.7	6.8	8.4	9.2	11.0
Group 2....	14.8	12.4	4.8	1.2	8.0	12.5	9.7	13.5	11.9
Group 3....	6.6	12.4	8.2	6.2	14.7	13.1	27.0	26.1	28.9
Group 4....	8.3	13.3	8.4	10.0	12 8	7 9	10.0	15.7	19.7
Group 5....	4.9	13.0	13.7	18.3	13.5	39.7	28.8	20.4	24.9

*Decrease.

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July
INCOME:									
Group 1....	2.4*	0.6*	1.0*	0.4	8.1	4.0	3.1	9.0	5.3
Group 2....	1.1	1.0	4.9	8.0	7.5	9.4	12.7	11.1	13.0
Group 3....	3.5*	1.0	0.6	2.6*	1.0*	0.3*	3.4	3.6	7.9
Group 4....	1.4	6.5	6.2	0.6	2.6*	3.8*	8.7	1.6*	10.9
Group 5....	3.1*	2.5*	1.8	2.0*	3.5*	2.7*	2.4*	3.3	4.5
OUTPUT:									
Group 1....	2.1*	0.0	1.5	0.5*	2.5	4.5	2.3	10.8	7.1
Group 2....	7.7*	13.0*	7.2*	13.5	3.0	11.6	19.0	14.9	27.5
Group 3....	14.1*	14.2*	13.5*	11.5*	4.0*	3.5*	3.8	12.4	8.4*
Group 4....	4.4	3.7	9.5	0.6*	9.5*	4.7*	87.0	4.5*	20.0
Group 5....	2.9*	1.0	4.1	9.9	18.0	9.6	18.5	3.6	10.9

*Decrease.

Burning Coke on an Ordinary Flat Boiler Grate

Experimenting with blast furnace and gas cokes in factories and electric plants carried on by German authorities since the beginning of the war seems to show that under favorable draft conditions pure coke can be satisfactorily burned on an ordinary flat grate. It was found that large-sized coke can be burned on flat grates with hand firing only when a strong draft and a good grate cooling are available, as in locomotives. In order to use small coke not mixed with coal, special types of grates with blowers under them were required. This size of coke could be burned on the ordinary flat grate, however, when mixed with an easily baking coal. In the district of the Bergisch Steam Inspection Association several concerns are reported as using a mixture of two parts of coal to one part of coke, hand-fired on flat grates with fairly good results. Gas coke has been found more satisfactory in boiler furnaces than blast-furnace coke.

When using a coke-coal mixture on an ordinary flat grate, the furnace must be fired up with pure coal and the coke-coal mixture not used until after the fire has burned up well and is of high temperature. The fuel bed must also be kept somewhat thicker than with coal. In order to prevent unconsumed coke from falling through the grate when cleaning the clinkers, it has been found advisable to use pure coal some time in advance of the time of cleaning so that the fire will burn away uniformly.

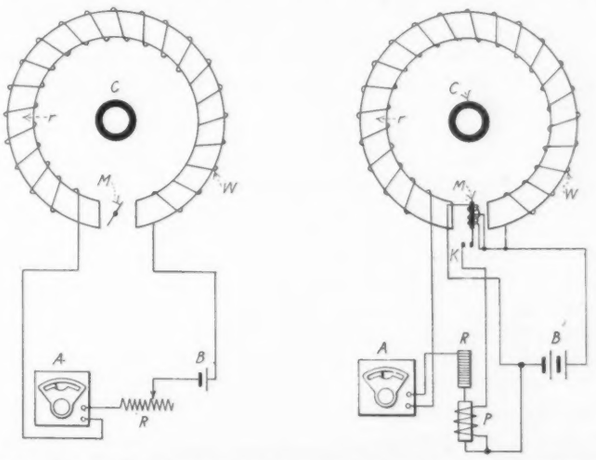
Little success was secured when attempting to burn pure coke on traveling grates. When coal is burned on traveling or chain grates the ignition of the gases keeps the arch at a high temperature, a feature that permits the combustion of coals rich in gases with little smoke. When coke is used in a furnace of this character, however, there is no flame and the arch remains at a much lower temperature than with coal. As the coke moves forward on the grate there is difficulty in maintaining a zone of incandescence and the fire goes out. A mixture of one-fourth coke and three-fourths coal has been found to burn fairly successfully, however, on chain grates.

Measuring the Current in D. C. Circuits

A Method That Does Not Require Circuit to Be Opened and Is Suited to Large and Small Current Measurements—Adapted to Central-Station and Electrolysis Work

BY OTTO A. KNOPP

IN making direct-current tests in power stations and in other cases where it is undesirable or expensive to interrupt service or open circuits to make connections a method for securing such measurement quickly and accurately is very advantageous. Special apparatus for this purpose has been devised by the engineering department of the Pacific Gas & Electric Company. This apparatus operates on the principles shown in Fig. 1. The device consists of a split iron ring arranged so that it may be slipped over the conductor whose current is to be measured. This ring carries a secondary winding consisting of a number of turns of fine wire with a low-voltage battery, a variable



FIGS. 1 AND 2—OPERATING PRINCIPLES OF NON-AUTOMATIC AND AUTOMATIC APPARATUS

resistance and a direct-current ammeter connected in series. In the gap between the two poles of the split ring a small magnet needle is placed so that when current flows in the conductor shown as *C* in Fig. 1 a magnetic flux is set up in the iron ring which may be neutralized by the current in the auxiliary winding. The position of the small needle shows when this neutralization occurs or when the ampere turns of the conductor and the auxiliary wiring are equal. The current in the conductor *C* is then obtained from the reading of the ammeter multiplied by the ratio of the turns of auxiliary winding and conductor.

The device has been built in two forms, one known as the direct-current ratio relay and the other as the direct-current line-current-testing set. In the first design the secondary current is made to follow automatically the fluctuation of the line current, and in the other the current in the secondary circuit is controlled by the observer. The first type is shown in Fig. 3 and the second type in Fig. 5. The circuit diagram for the automatic instrument is shown in Fig. 2. In this design any magnetization due to unequal primary and secondary ampere turns causes a deflection of the electromagnet *M*, which in moving opens or closes a relay contact at *K*. If the primary ampere turns are in excess, the contact at *K* closes, the relay *P* is energized, and its plunger compresses a small carbon pile rheostat *R*, causing the secondary current to increase until the secondary ampere turns are slightly in excess and contact *K* opens. When current in the relay *P* is interrupted at *K*, the plunger recoils, the resistance of the carbon pile *R* increases, and the secondary current falls until the contact at *K* closes again. There is thus maintained in the secondary circuit a pulsating current, the average value of whose ampere turns is exactly equal to the ampere turns of conductor *C* threading the coil.

The non-automatic or direct-current line-current-testing set is based on the same operating principles as the ratio relay, with the automatic rheostat in the latter replaced by a small hand-operated compression carbon rheostat.

The ratio relay accomplishes for direct-current measurements what the current and potential transformer accomplishes in the measurement of alternating current and electromotive force. By means of this apparatus and a standard low-rated direct-current ammeter variable direct currents of several thousand amperes can be measured with the same facility and with greater accuracy than alternating currents of equal magnitude can be measured with a split-core current transformer. By means of a high-resistance primary winding of a large number of turns, properly insulated, the relay can also be used to measure direct-current electromotive force of any magnitude, such, for instance, as the potential of a direct-current magnetite-arc circuit, which may run as high as 9000 volts, or other high direct-current potentials such as are used in railway and constant-current transmission, with the added advantage that the high potential being measured is not carried through the measuring instrument.

Two methods are used for operating the non-automatic instrument. One is called the zero-flux method, the other the residual-flux method. When using the zero flux method, the object is to keep the secondary current alternatively above or below the value necessary to neutralize the flux produced by the primary

FIG. 3—AUTOMATIC RATIO RELAY AND INDICATING METER

current; in other words, to keep the flux in the core oscillating as closely as possible around the zero flux point. This method will give excellent results for primary ampere turns over one hundred and up to the largest likely to be used in practice. This method can be used for current of any magnitude, if for currents below 100 amp. a number of turns are used in the primary. For all measurements where it is desirable to slip the core over the conductor, this method will give good results from 100 amp. up. Below 100 amp. the accuracy of the measurements decreases rapidly, and below 20 amp. the method becomes inoperative, as it requires some twenty ampere turns to throw the needle one way or the other in the instrument.

The second method under which the non-automatic instrument can be operated is the residual-flux method. In this method use is made of the residual magnetism which is left after a definite magnetization. This magnetization is obtained by sending the full-load current through the secondary for an instant. After this the secondary current is raised slowly, flowing in the opposite direction, until a small signal lamp indicates that the flux has been neutralized. The reading obtained on the ammeter at this moment will be a constant value and can be used as an instrument constant for determining small currents. If, for instance, after such a preliminary magnetization, the core is placed over a conductor carrying a small current, this current will either strengthen or weaken the residual magnetism in the core, and the current necessary to neutralize this altered flux will be either larger or smaller than the constant mentioned. The difference between the constant and the value read on the ammeter will equal the current flowing in the conductor.

Both the automatic and the non-automatic instruments have a wide field of application, being of particular value in all cases where it is undesirable or expensive to interrupt the service or to open the circuit for the purpose of current or power measurements and where it is essential that no additional resistance be introduced into the circuit in which measurements are made.

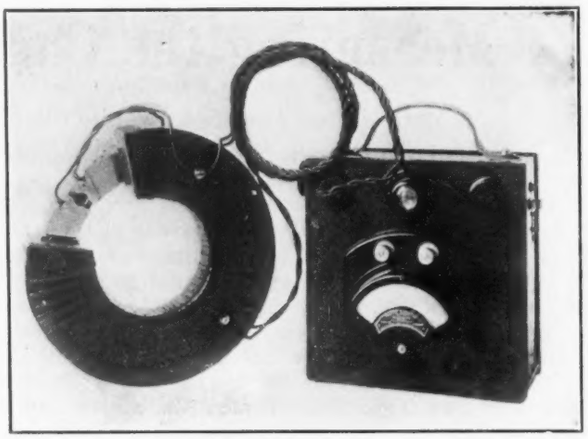


FIG. 5—HAND-OPERATED RATIO RELAY AND INDICATING METER KNOWN AS LINE-CURRENT-TESTING SET

It is often advantageous to measure current and power transmitted through a conductor at a distance. In this case the ratio relay is of value, as the resistance of the secondary has no effect upon the accuracy of measurement, and it is therefore possible, with less copper than would be required with alternating current, to transmit measurements over great distances.

The non-automatic instrument, on account of its wider range, flexibility and simple construction, has been used mostly for distribution and electrolysis work, whereas the automatic instrument adapts itself particularly for the permanent integration of large direct-current power with a small direct-current meter and for testing medium and large size direct-current ammeters, wattmeters, ampere-hour or watt-hour meters.

FIG. 4—THE AUTOMATIC RATIO RELAY BEING USED TO MEASURE CURRENT FROM A DIRECT-CURRENT MACHINE

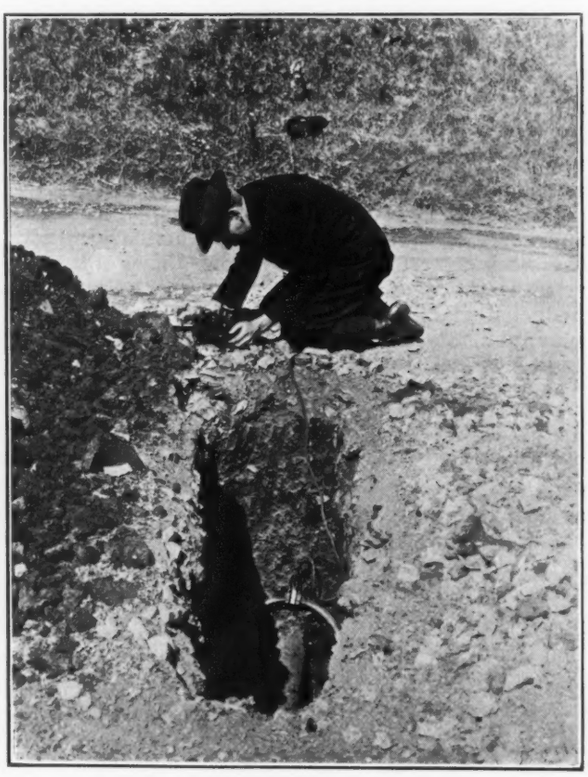


FIG. 6—THE LINE-CURRENT-TESTING SET BEING USED IN ELECTROLYSIS INVESTIGATIONS

Station and Operating Practice

A Department Devoted to the Problems of Installation, Operation and Maintenance of Equipment for the Economical Generation and Distribution of Electrical Energy for All Uses

A Method of Anchoring and Tightening Switchboard Instrument Buses

BY C. H. SANDERSON*

It is often said that the real merits of a switchboard lie in the design and arrangement of the parts on the backs of the panels. A well designed and executed scheme of switchboard wiring always conveys to the casual observer the impression of system and therefore safety in operation of the entire electrical installation.

It has been a long and difficult problem to devise a system of instrument bus wiring such that it would always be free from unsightly sagging. The instrument

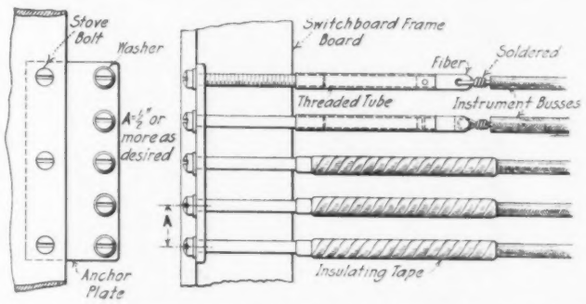


FIG. 1—TIGHTENING ANCHORS FOR INSTRUMENT BUSES SHOWN IN PLACE

buses must necessarily be installed in an accessible, and therefore a very prominent, position, and because of their parallel arrangement and usual length the least sagging is at once apparent. Moreover, bus connections which are frequently made or unmade, as well as work on other parts of the board, often cause derangement of these trunk wires, resulting in kinking and sagging.

Many schemes have been employed for eliminating this difficulty, some of which are designed to tighten the entire set of buses as a unit, while others permit separate tightening of the individual members. The difficulty has been avoided in other instances by the use of brass or copper rods or tubes for buses instead of copper wire. The danger of short-circuits, however, de-

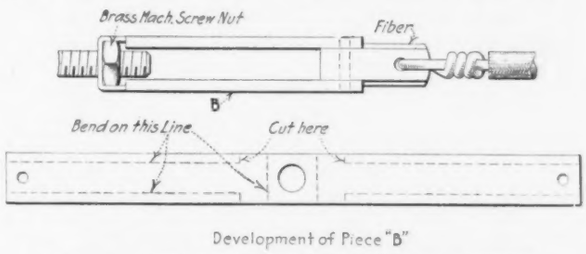


FIG. 2—DETAILS OF A SHEET-METAL ANCHOR

mands that they be protected with insulating tubing or tape, which involves additional labor and expense.

The most practicable material for buses for the majority of installations is No. 10 to No. 6 copper wire, preferably with 600-volt rubber or varnished-cambric insulation and one or more protecting braids, the outer of which should be flame-proof. Fig. 1 shows a practicable and simple method of anchoring the buses at their ends, which at the same time keeps them permanently taut. The amount of slack which may be taken up depends entirely on the length of machine screw and threaded tube employed. It is obvious that their lengths should be proportioned to the length of the buses.

All the materials used are ordinarily found in any electrical storeroom or hardware store. If, however, it is found more convenient to use sheet metal in place of tubing, the arrangement shown in Fig. 2 may be employed. It will be found, however, that the arrangement shown in Fig. 1 will usually present the better appearance. This method may readily be applied to either angle or tubular frames, and to control desks or instrument stands, as well as switchboards.

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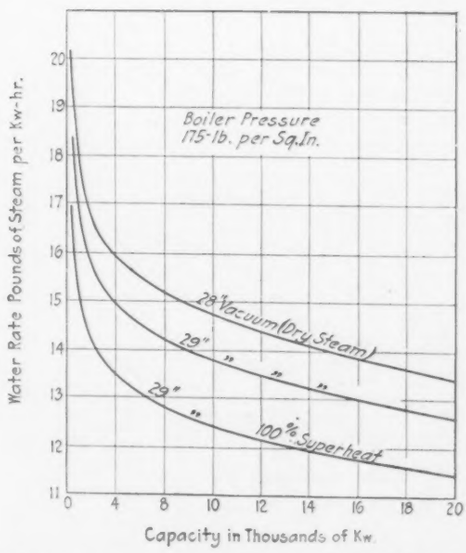
Relation Between Steam-Turbine Rating and Water Rate

In a paper presented at the convention of the Association of Iron and Steel Electrical Engineers held at Detroit, Sept. 8 to 11, P. M. Lincoln, past-president of the American Institute of Electrical Engineers, referred to the economy wrought by the units installed during the past year in the power house of the Interborough Rapid Transit Company of New York as the high-water mark in steam-turbine operation. Under specified conditions of operation—namely, 200 lb. boiler pressure, 120 deg. superheat and 29 in. vacuum—the economy is



RELATION OF WATER RATES TO TURBINE RATING

even better than the guarantee of 11.27 lb. of water per kilowatt-hour at the busbars. Up to date this is the best water rate ever secured by any apparatus deriving its power from steam. Such high economy is due in considerable part to the large size of the particular unit. The normal rating of this unit is 30,000 kw., but in actual practice it has been found to be good for from 10 to 15 per cent more than this.

The curves herewith show the relation between the

output of steam-turbine units and the water rates at the best load and give results for three conditions of steam supply. Under actual operating conditions, the slope of the water-rate curve is much more than indicated in these curves, since steam conditions also vary with unit size. It is only in plants using units of the larger sizes that it pays to secure the higher vacuums, superheats and boiler pressures that add so much to economy in water rate. A plant operating a 1000-kw. unit, the author maintained, would not save enough in fuel to make it pay to install the boiler and condenser equipment necessary to secure the highest possible superheat and vacuum, while in one using a 30,000-kw. unit the installation of such equipment would pay handsomely.

Economy in water rate is not the only advantage possessed by the larger-size unit. An increase in the amount of load brings economies in practically every direction. For instance, there is no inherent reason why a plant containing a given number of 30,000-kw. units should require a larger number of attendants for turbine and generator operation than one containing the same number of 1000-kw. units. There usually are a larger number provided in the 30,000-kw. plant for the purpose of securing a higher degree of reliability rather than from any fundamental necessity.

Ways of Handling Outgoing Lines from a Generating Station

Three methods of caring for the outgoing lines from a generating plant are shown in the accompanying illustrations. The steam plant shown in Fig. 1 supplies electric service to a group of railroad shops. The principal feeders are carried from the station buses in 3.5-in. conduit underground to the steel tower just outside the building. This tower is 45.5 ft. high and is built of 2.5-in. by 0.375-in. steel angles, with lattices of the same cross-sectional area. The tower is mounted on a 5-ft. 9-in. by 14-ft. concrete pier with 1.5-in. foundation bolts, and carries a platform of 2-in. plank about 9 ft. above the ground which supports transformers and meters connected with a 2300-volt circuit feeding a distant corner of the shop yard. The arrangement avoids the use of roof and wall bushings in the station, and gives increased space inside the building compared with the usual plan of running feeders spread well apart from the rear of the switchboard to the outgoing line insulators. Besides, an accessible construction is provided.

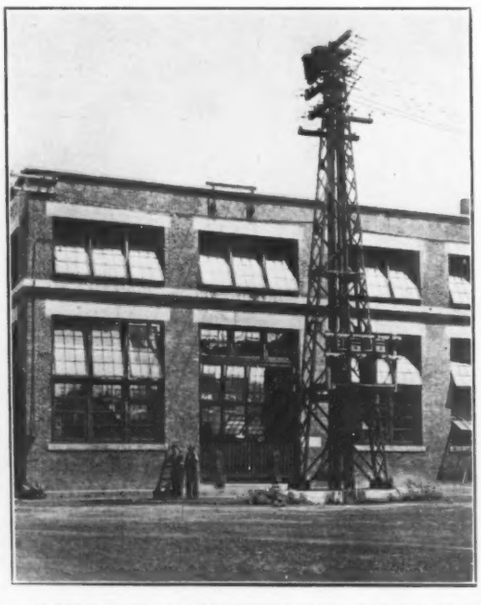


FIG. 1—TOWER USED AS DISTRIBUTION CENTER FOR STEAM PLANT SERVING RAILROAD SHOPS

In Fig. 2 are shown the present method and a discarded one of running cables out of a hydroelectric-

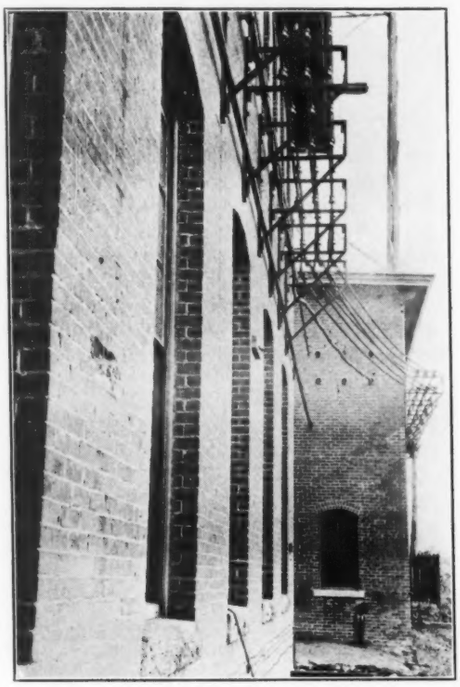


FIG. 2—USE OF CABLE AND OPEN CONSTRUCTION FOR LINE SERVING STATION

station generating room to a transformer house near by. Originally the outgoing lines were run to the transformer house in lead-covered, rubber-insulated cable, but the lack of radiating surface led to excessive heating. In the new arrangement the cables are run in the open, mounted on insulators within rectangular iron frames to prevent the lines from sagging over a tailrace in case an insulator breaks.

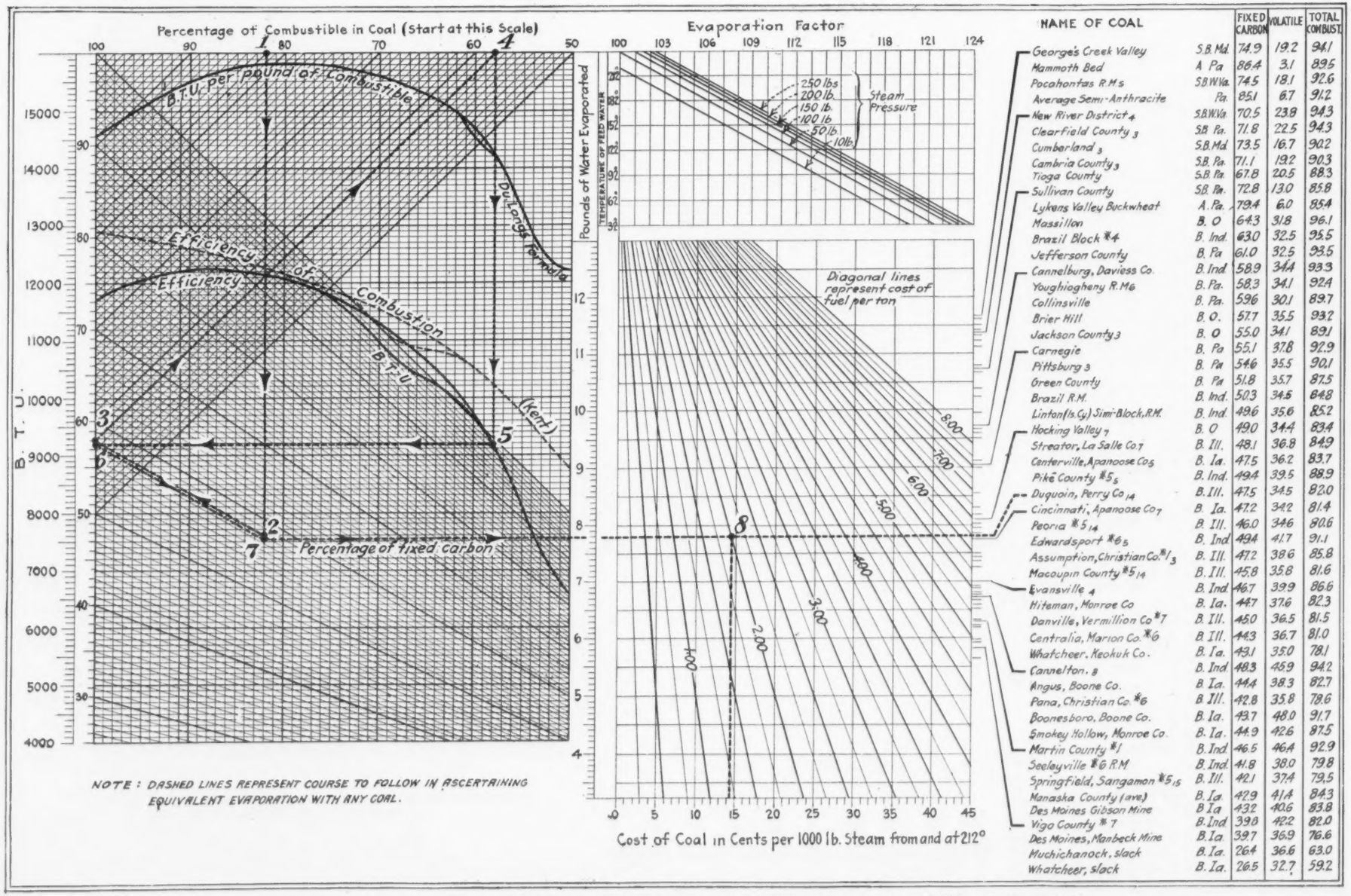
A Simplified Method of Determining Cost of Coal per 1000 Lb. of Steam

By W. H. SCHOTT*

The accompanying chart has been devised to ascertain quickly the cost of any fuel required to produce a thousand pounds of steam. If the fuel is given in the column at the right, it is only necessary to follow the arrow opposite the particular fuel to where it untersects the diagonal line representing the cost per ton and then drop vertically to the scale giving the cost of coal per 1000 lb. of steam from and at 212 deg. Fahr. Refer next to the evaporation chart above and follow the horizontal line from the feed-water temperature until it intersects the diagonal line representing the steam pressure. Directly above will be the evaporation factor. Multiply this factor by the cost of fuel per unit of equivalent evaporation, and the actual cost of coal to produce 1000 lb. of steam is determined. The arrows opposite the fuel in the column at the right of the chart point to the amount of evaporation which can be expected by burning 1 lb. of the particular fuel.

When the fuel used or considered is not listed in the

*Engineer Harris Trust Building, Chicago.



NAME OF COAL		FIXED CARBON	VOLATILE	TOTAL COMBUST.
George's Creek Valley	S.B.Md.	74.9	19.2	94.1
Hammoth Bed	A. Pa	86.4	3.1	89.5
Pocahontas R.M.s	S.B.W.Va.	74.5	18.1	92.6
Average Semi-Anthracite	Pa.	85.1	6.7	91.2
New River District 4	S.B.W.Va.	70.5	23.8	94.3
Clearfield County 3	S.B. Pa.	71.8	22.5	94.3
Cumberland 3	S.B. Md.	73.5	16.7	90.2
Cambria County 3	S.B. Pa.	71.1	19.2	90.3
Tioga County	S.B. Pa.	67.8	20.5	88.3
Sullivan County	S.B. Pa.	72.8	13.0	85.8
Lykens Valley Buckwheat	A. Pa.	79.4	6.0	85.4
Massillon	B. O	64.3	31.8	96.1
Brazil Block *4	B. Ind.	63.0	32.5	95.5
Jefferson County	B. Pa	61.0	32.5	93.5
Cannelburg, Daviess Co.	B. Ind.	58.9	34.4	93.3
Youghiogheny R.M6	B. Pa.	58.3	34.1	92.4
Collinsville	B. Pa.	59.6	30.1	89.7
Brier Hill	B. O.	57.7	35.5	93.2
Jackson County 3	B. O	55.0	34.1	89.1
Carnegie	B. Pa	55.1	37.8	92.9
Pittsburg 3	B. Pa	54.6	35.5	90.1
Green County	B. Pa	51.8	35.7	87.5
Brazil R.M.	B. Ind.	50.3	34.5	84.8
Linton(Is.Cy.) Simi-Block,R.M.	B. Ind.	49.6	35.6	85.2
Hocking Valley 7	B. O	49.0	34.4	83.4
Streator, La Salle Co 7	B. Ill.	48.1	36.8	84.9
Centerville, Apanoose Co 5	B. Ia.	47.5	36.2	83.7
Pike County *5 5	B. Ind.	49.4	39.5	88.9
Duquoin, Perry Co 14	B. Ill.	47.5	34.5	82.0
Cincinnati, Apanoose Co 7	B. Ia.	47.2	34.2	81.4
Peoria *5 14	B. Ill.	46.0	34.6	80.6
Edwardsport *6 5	B. Ind	49.4	41.7	91.1
Assumption, Christian Co.*1 3	B. Ill.	47.2	38.6	85.8
Macoupin County *5 14	B. Ill.	45.8	35.8	81.6
Evansville 4	B. Ind	46.7	39.9	86.6
Hiteman, Monroe Co	B. Ia.	44.7	37.6	82.3
Danville, Vermillion Co *7	B. Ill.	45.0	36.5	81.5
Centralia, Marion Co. *6	B. Ill.	44.3	36.7	81.0
Whatcheer, Keokuk Co.	B. Ia.	43.1	35.0	78.1
Cannelton. 8	B. Ind	48.3	45.9	94.2
Angus, Boone Co.	B. Ia.	44.4	38.3	82.7
Pana, Christian Co. *6	B. Ill.	42.8	35.8	78.6
Boonesboro, Boone Co.	B. Ia.	43.7	48.0	91.7
Smokey Hollow, Monroe Co.	B. Ia.	44.9	42.6	87.5
Martin County *1	B. Ind	46.5	46.4	92.9
Seeleyville *6 R.M	B. Ind.	41.8	38.0	79.8
Springfield, Sangamon *5 15	B. Ill.	42.1	37.4	79.5
Manaska County (ave.)	B. Ia.	42.9	41.4	84.3
Des Moines Gibson Mine	B Ia	43.2	40.6	83.8
Vigo County *7	B. Ind	39.8	42.2	82.0
Des Moines, Manbeck Mine	B. Ia.	39.7	36.9	76.6
Muchichanock, slack	B. Ia.	26.4	36.6	63.0
Whatcheer, slack	B. Ia.	26.5	32.7	59.2

A CONVENIENT CHART FOR ASCERTAINING QUICKLY THE FUEL COST TO GENERATE 1000 LB. OF STEAM

column at the right the proportions of combustible and fixed carbon must be known and the evaporation per pound of fuel estimated. After this is found the procedure is the same as for fuels listed in the chart.

The diagram on the left is to facilitate ascertaining the equivalent evaporation obtainable with a pound of fuel. The method of using it is as follows:

Start with the percentage of combustible matter in the fuel (at the top of the left-hand diagram) and follow the vertical line downward to the horizontal line representing the percentage of fixed carbon, thence upward along the diagonal line to the left-hand margin, where the percentage of carbon in the combustible will be obtained. From this point proceed upward along the diagonal line to the top margin, then downward along the vertical line to the efficient B.t.u. curve and horizontally to the scale marked B.t.u. (which gives the calorific value on 1 lb. of combustible). From this point again follow the diagonal line downward until it intersects the vertical line marked with the percentage of combustible in coal and thence horizontally to the scale marked "pounds of water evaporated."

These charts are based on the efficiency which should be obtained with high-class operation. The upper curve in the left-hand diagram is based on Du Long's formula for figuring the B.t.u. in the combustible. The dotted curve is for determining the efficiency which should be obtained when burning coal under good conditions. The basis for charts similar to these was furnished by the author to the station-operating committee of the National District Heating Association for presentation at its convention.

An Incident That Shows the Importance of Correct Synchronizing Connections

BY E. C. PARHAM

Some switchboards are wired for closing the main switch between two alternators when the synchronizing lamps are brightest. Others are wired for closing the switch when the synchronizing lamps are dark. Both methods are good. However, before synchronizing two machines for the first time the operator should examine the board to ascertain for which method the lamps are connected. For synchronizing "dark," a given lamp *a* or *b* (Fig. 1) will be connected to directly opposite terminals of the switch; for synchronizing "light," a given lamp *a* or *b* (Fig. 2) will be connected to diagonally opposite terminals of the switch. In the first case, closing of the main switch will extinguish the synchronizing lamp or lamps, while in the second case it will not. In both cases the lamps will be brightest when maximum emfs. concur in the circuit completed by the lamps and the lamps will be dark when the emfs. are opposed. In Fig. 1, in which the lamp connections are straight, opposing, equal, synchronous emfs. produce zero current. In Fig. 2, however, where the lamp connections are on the diagonal, opposing, equal, synchronous emfs. of the mains concur in the lamps, so that phase opposition and synchronism are indicated by maximum lamp brightness. The diagrams indicate that any attempt to synchronize for either condition when the connections are for the opposite condition will cause a short-circuit.

An incident in a small municipal plant where a new generator had been installed shows the importance of this apparently simple matter. When the day came for throwing the two machines together every officer of prominence was on hand. The old operator had been duly coached by the operator of a neighboring plant, but he had received his instruction in the neighboring station. He brought the incoming machine up toward normal speed, and as soon as the synchronizing lamps indicated "bright" he closed the switch. The station voltage went down, and both of the machines showed their distress by a series of tugs and intense groans; however, they soon pulled together, and as far as could be determined no damage was done. The official corps were entirely satisfied, but the old operator was not. He took counsel with his mentor from the other station and together they compared the lamp connections of the two stations. They did not know much about the theory

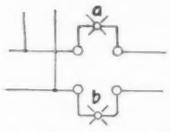


FIG. 1 — LAMP CONNECTIONS FOR SYNCHRONIZING DARK

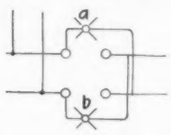


FIG. 2 — LAMP CONNECTIONS FOR SYNCHRONIZING LIGHT

of synchronizing, but were able to see that the connections of the two stations were different and made them alike by changing the connections of the newer outfit from those indicated in Fig. 1 to the connections of Fig. 2. When the machines were then synchronized the lamps showed "bright" and the trouble of the day before was absent.

What the Operator Should Know About Slotted Commutators

The slotting or grooving of commutators by cutting away the mica below the surface of the copper is a practice that seems to be effective in the prevention of some commutator and motor troubles. Advocates of this practice claim that during the last eight years since commutators have been so treated about 70 per cent of annoying motor troubles, such as flash-overs, grounded and burned-out armatures, have been reduced or effectively handled with a saving of commutator wear and increase of brush life. Slotting has been most extensively practised in the electric-railway field and is now being applied to other motors where commutating conditions are severe, as with crane and elevator motors, and to some extent to the commutators of direct-current generators and rotary converters where the peripheral speed is high enough to prevent dirt from collecting in the grooves between the bars.

When operating machines with slotted commutators certain precautions must be observed to secure the best results. By blowing out frequently with compressed air, the slots should be kept free from oil, dirt, carbon and copper dust to prevent short-circuits between bars. Oil or grease forms a gummy deposit when mixed with carbon or copper dust and cannot be blown out of the slots, so that a careful inspection should be frequently made to see that oil from bearings is not leaking into the motor case and getting on the commutator. The use of high-grade carbon brushes is advised for slotted commutators. Brushes that wear away rapidly and cause a considerable carbon dust should not be used. The brush tension with slotted commutators is usually less than with a non-slotted commutator. For railway work the brush pressure usually varies from 4 lb. to 7 lb. per square inch of surface contact, while for stationary machines the pressure varies between 1.5 lb. and 3 lb. per square inch. The determining factors in slotting commutators are the peripheral speed of the commutator, the percentage of mica, and the grade of the brush used. The size of the machine has little or nothing to do with it, except that the conditions—high speed, large percentage of mica and high-current-density brushes—are usually found in large machines.

Marketing Electricity

A Department on Selling Service and Widening the Use of Electrical Energy

Electric Service as a Reason for Town Pride

Why the Central Station Is So Seldom Featured by the "Brag Squad" of Its Home Community—Whose Fault It Is

BY E. BURT FENTON*

IN every city in the land there are two elements in the population that wield tremendous influence for the betterment or the detriment of the men who represent its business interests. They are, in the common parlance of the day, the "boosters" and the "knockers," and they little realize what power they exert. For, after all, a personal testimonial is far more interesting to every one of us than any printed sign or printed message that the most energetic local board of trade has ever published. In fact, the Chamber of Commerce itself accomplishes its best work through the enlightenment and stimulation of the men and women in the community, that they may individually become "boosters" for the town and all its institutions.

The Song of the "Brag Squad"

Every live town has its "brag squad," as they aptly call it in the West. The more alive the town the bigger the membership in this purely voluntary army and the better the quality of the "brag" produced. And the stranger who visits the community is in contact with it from the time he steps down on the station platform till he travels on, impressed with all the wonders he has heard of and seen. The man he speaks to at the station as he asks his way to the hotel gives him his first impression of the town. He says: "Right over there and around the corner. You will find it one of the finest hotels in the State. They'll make you comfortable and treat you right." And so it goes. The chance acquaintance in the hotel lobby, the clerk, the barber, the newsboy, the conductor on the street car—every one of them passes out a word of cheer and confidence. Every man who has been about the country much is familiar with the "brag squad's" comments. They run like this:

"Yes, sir, for its size this town has one of the best police forces to be found anywhere in the country."

"Did you know we have the largest crayon works in the world here? Our crayons go all over the world?"

"Have you noticed our parks? Ever seen any finer ones for their size? We're proud of 'em."

"Our water-works system is the best in this section of the country."

"Say, you should see our fire department in action. It's a wonder. Bill Hawkins, the chief, is recognized all over the State as the best man in that job."

"You know, of course, that we make more paving brick here than any town in the country."

"This is a great town to raise children in. We've got the finest schools of any city of our size in the Middle West. And, man, it's healthy here! Lowest death rate in the State."

And so on.

They even tell about one booster who was garrulously enthusiastic over the number, variety and quality of the cemeteries appurtenant to his town.

But—how often do you hear one of the "brag squad" grow enthusiastic over the lighting company in his town? How often do you hear the good service, the excellent street lighting and the fine treatment accorded patrons expounded as a means of "boosting" the place? And yet, why not? The answer is not hard to find.

The trouble is that electric service is not a visible monument that cannot be overlooked nor yet forgotten. It is not like the new high school that can be pointed out with pride. It does not bring itself to the immediate attention of every visitor and automatically suggest itself to the "booster" who may be in eager search for something more to boast of to the stranger. The part that the central station plays is an abstract feature of the community, and because it is so largely out of sight it naturally comes to be taken as a matter of course. The service may be letter perfect. The cost may be low. The treatment accorded the public may excel the politeness of Alphonse and

*Mr. Fenton is the manager of the publicity department of W. S. Barstow & Company, 50 Pine Street, New York City. His own field headquarters are with the Sandusky Gas & Electric Company, Sandusky, Ohio. Mr. Fenton's paper on "Snuggling Up to John Smith," presented at the recent convention of the Ohio Electric Light Association, attracted wide attention.

Do You Know

That the Electrical Industry is the biggest thing in Boomville?

That nearly all other industries depend upon this one for power and light?

That practically all of the stores and shops and a large proportion of the residences rely upon it as their only source of artificial light?

That hundreds of housewives have their daily burdens lightened and made easier by using the service it supplies?

That it has lessened the cost of living and the cost of doing business because it does its work more efficiently than any other agency?

That its contribution to the safety of person and property in this town is greater than those of the police and fire departments?

That the business, social, educational, moral and religious life of the city have been improved because this industry exists?

And that these things are true because this company is operated on the basis of SERVING THE PUBLIC in the most efficient manner possible by remaining "on the job" EVERY SECOND OF EVERY TWENTY-FOUR HOURS?

Isn't it worth while to tell your out-of-town business and social acquaintances—and the stranger passing through with whom you chance to meet—that this town can boast of one of the best Electric Light and Power companies in the country?

Do you know of a better way of "booming" Boomville?

The Boomville Light & Power Co

Telephone 23

ADVERTISING TO THE CIVIC SENSE OF THE COMMUNITY

Gaston. But the town booster never thinks to mention it as one of the attractions of the place, in spite of the fact that the influence of the electric company is one of the largest single factors in the civic, intellectual, moral and industrial development of the town. It is a vital element in the family life, the commercial life and the industrial life of the community, and every man appreciates it when you focus his attention on it.

Why, then, shouldn't it be "boosted" and "bragged" about, on equal terms with the police and fire departments, the water-works, the cemetery, the new Carnegie library and the architecturally-freakish county court house? Is it because the central-station men have been overlooking the opportunity? Because they do not talk enough in print and on the streets about the large and beneficial part they are playing in their town's development?

The Simple Remedy

There is no good reason why every resident of every town should not be as proud of his central-station service as of his other civic institutions and industries, and every electrical man can, if he will, help inoculate the "brag squad" with an enthusiastic belief that the service which the central station renders is worth shouting about. It is merely a question of "tooting your own horn" in the right quarters—and all the time. Failure to do this may enhance your reputation for modesty—but in this connection modesty is not a virtue. It is a crime.

But no man's modesty need be involved. It is not a matter of "brag" in so far as the central-station manager is concerned; it is a matter of giving information and enlisting the ready interest of the public. The work done by electricity in every city affects each man and woman intimately. The whole broad subject of electricity in all its applications is a fascinating one that never fails to win attention, and the story only needs the telling.

Opportunity in Civic Service

Among the duties of the central-station manager there is no more essential obligation and responsibility than the nurturing of public sentiment by an active, eager participation in all the civic enterprises of the community. And if he is a working member of the board of trade, and if the other employees of the company are conspicuous in their interest in all the social and business movements of the town, the part that electric service plays soon becomes a matter of general comment. It wins the friendship of the people and gives the opportunity for the featuring of frequent news about the company that will sustain the interest and prevent the most short-sighted visitor from overlooking the importance of the surpassing service to the common comfort. In the city where the central-station manager, in addition to giving good electric service, has made himself a leading civic worker in the town one always finds that "Cheap electric power" is a slogan of the board of trade. We find that newspapers are friendly and the public sympathetic and the stranger learns immediately that "we've got one of the finest electric power stations in the country right here in this town; service is good, rates are low and the company treats everybody fair and square. You certainly ought to come down here to live."

And no man can compute the influence and value of such support.

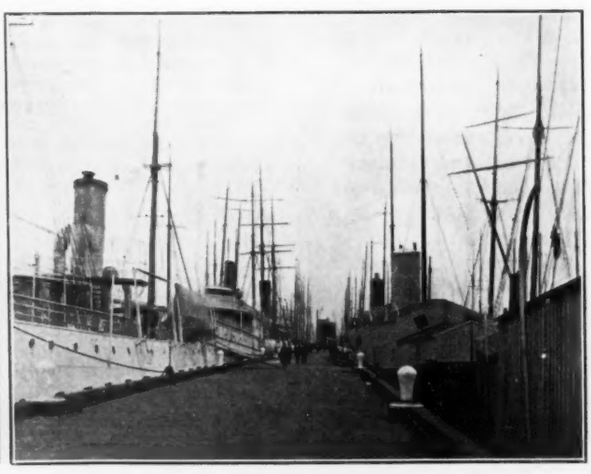
Preaching Electric Service from the Housetops at Janesville, Wis.

The picture reproduced herewith shows the very extraordinary wall sign on the side of the office building of the Janesville Electric Company at Janesville, Wis. This sign, which is painted on the rough brick surface of the building wall, is lighted by seven 200-watt gas-filled lamps with billboard reflectors, and since the company's office occupies one of the most prominent corners in the city, this advertising display has proved itself very valuable as a means of attracting the interest of the public and suggesting universal use for electric service. The unique idea of the sign consists, of course, in showing the various rooms in an average dwelling, with suitable lighting and electrical appliances for each. P. H. Korst is president of the Janesville company.

Central-Station Energy for Private Yachts While at Dock

To eliminate the necessity of operating electric-lighting plants on private yachts while they are "docked," the Edison Electric Illuminating Company of Brooklyn, N. Y., makes a practice of supplying energy to the Tebo Yacht Basin Company, which in turn delivers it to the boats from marine outlets on the piers. The total energy consumed is measured in the office of the Yacht Basin Company, while that supplied to each boat is measured by meters on the yachts. A maximum-demand meter is also installed in the office. The average peak load is about 10 kw., twenty 500-watt lamps being connected in the office and about 2500 50-watt lamps on the yachts, of which there are sometimes twenty tied up at the piers.

"DOING IT ELECTRICALLY" AT JANESVILLE, WIS.



YACHTS UNDERGOING OVERHAULING AT BROOKLYN

"Why Central Stations Do Not Get All the Big Power Business"

Frank Discussion from the Viewpoints of Both the Factory Manager and the Motor-Service Solicitor in Symposium at Kineo Convention of New England Section

Among the interesting features of the convention of the New England Section of the N. E. L. A. at Kineo, Me., which was reported in last week's issue, were the presence at the sessions by invitation of several factory managers and the presentation by these guests, and by their central-station hosts as well, of a group of papers discussing various phases of the topic "Why Central Stations Do Not Get All the Big Power Business."

Those who took part in this symposium were John J. Gillespie, United Shoe Machinery Company, Boston; H. B. Emerson, Arlington Mills, Lawrence, Mass.; K. P. Applegate, Hartford (Conn.) Electric Light Company; Jesse E. Gray, Narragansett Electric Lighting Company, Providence, R. I.; James E. Spike, Cambridge (Mass.) Electric Light Company; John West, C. H. Tenney & Company, Boston, and H. W. Eells, Central Maine Power Company, Augusta, Me.

IN opening the discussion on this topic, Mr. Gillespie emphasized the importance of the heating problem in securing large power business and urged that central stations take up this line of service, covering both industrial heating and the heating of buildings. Scarcely 6 per cent of the live steam in a shoe factory is, for example, required for power production. The author also advocated simplifying contracts and rate schedules, and pointed out that customers are not interested in the central-station man's troubles, but desire the best service and at a cost spelling either economy of operation or increased production at the machine. A central station should cultivate the use by its men, of methods which include the study of human nature and the ability to tell "the whole story" in such a manner as to leave an indelible impression upon the consumer's mind, no matter what may be the size of his installation. Service is the greatest business-getter in American money-making, declared the speaker. Responsibility does not cease at the completion of a sale, but, on the contrary, it commences and continues from that moment.

Estimates of Production Costs

Mr. Emerson cited the following as reasons why individual industries build their own generating plants: First, because owners can obtain cheaper energy in this way, and, second, because they have absolute control over this energy. The author contended that a number of private plants in industrial service are producing energy at costs of from 0.75 cent to 1 cent per kilowatt-hour, including fixed charges. He presented illustrative figures for power cost in a plant generating 10,000,000 kw.-hr. annually on a working year of 2730 hr., and reached the conclusion that the annual saving over central-station service purchased at 1 cent per unit would be $19,500.

The author took as his power-plant investment $220,000, covering one 3700-kw. turbo-generator with boilers and auxiliaries, and assumed a coal cost of $40,826; labor in boiler room, $2,850; labor in turbine room, $2,950; repairs, renewals and supplies, $3,146; total operating expenses, $49,772; interest, 6 per cent; depreciation on buildings, 2 per cent; depreciation on machinery, 5 per cent; insurance and taxes, 4 per cent—giving fixed charges of $30,750 per year. The author concluded that the total cost of production would be 8.05 mills per kilowatt-hour with coal at $4.75 per ton. In the discussion the point was, however, made that a modern central station would meet this rate without difficulty on such a large output, rendering the author's conclusion untenable.

Vagaries of "Prospects"

In approaching this topic, Mr. Applegate stated that at present there are only three reasons for the existence of private power plants: First, the central station may be at fault for not going after the large power business; second, the isolated plant has reasons other than costs for making its own power, and, third, the isolated plant has uses for steam for heating and manufacturing purposes in such large quantities that the percentage which is needed for the production of power is extremely small.

Citing cases in his own practice, the author stated that in one 1500-hp. installation the central station failed to get the business because the owners allowed practically nothing for fuel in figuring their costs, on account of the use of coaldust or screenings, and because the owners estimated that their lighting cost them nothing on account of their practice of using steam from banked fires.

In another instance the central-station report showed a saving of $300 a year by purchased power, but the owner would not give up his independence, as he expressed it, for this sum. This company is at present purchasing energy in large quantities for testing and heating, and it is hoped that this service will form an entering wedge for complete equipment. Again, where an owner placed more faith in the figures of his operating engineer than in the central station's, and the two disagreed, the installation of central-station service was held up in the absence of proof so conclusive that it could not be gainsaid.

"The Expense of Changing Over"

There are several companies in the Hartford territory which admit the advantages of central-station power but which are unwilling to contract for it because in their opinion their businesses do not warrant the expense of a change. This obstacle could probably be overcome by the power company's making a proposition whereby a part of their installation costs would be placed on the central station. Most of these cases do not exceed 100 hp.

Accurate data on heating can be obtained only by obtaining actual costs from operating plants. Some companies solve their heating problem by running an engine during the months when heat is needed. At other times the engine is shut down and service purchased. Plant managers generally figure heating costs at least 50 per cent too high and power costs 50 per cent too low. The last factories to change will undoubtedly be those which do not consider costs. Systematic attention is necessary, including prompt attention to service needed in any field other than power, making the acquaintance of plant heads in social as well as in business life, and continually keeping central-station service before them. Large business must be met with large-business methods, and a consumer must not be lost through the price of a transformer platform. The extra money that an isolated plant costs can be made to produce larger earnings if invested in the consumer's own business, and each manufacturer should keep to his own particular product and not go into power production.

Must Attack Problem Along Lines of Cost

Mr. Gray's paper pointed out that the advantages of the electric drive are usually no longer a factor in the choice between electrical service from an isolated plant or a central station, and most of the latter companies do not now claim that their service is materially better than that of a good isolated plant; so that the prospective customer must be convinced that the cost of operation will be less with central-station service. An engineering test and report on the plant is probably the best line of attack. The author discussed the form of the report as developed at Providence, which is so framed as to present the conclusions to the reader at the beginning of the material submitted, with full opportunity for checking data included in the body of the report and the appendix. Value has been added to later reports by the use of tabs designating its principal features, such as coal, labor, depreciation, etc., a method far preferable to an index.

Mr. Spike discussed various classes of isolated plants from the standpoint of generating equipment, the combination of rentals with power supply, unfamiliarity of industrial managers with electrical terms, mistaken opinions of factory owners that gas engines maintain continuous high economy, and the existence of water-wheel equipment as obstacles to the entrance of central-station service. He pointed out that the Cambridge company now has 521 power customers, the larger installations ranging from 1945 hp. to 225 hp. Some new customers are connected after investigating the plants of a few of the largest consumers on the system.

Broad Viewpoints in Soliciting Power Business

Mr. West's paper conceded that some competitive conditions of operation in manufacturing plants, such as utilization of waste product for fuel, exhaust steam heating and useful life of isolated plant apparatus, cannot be overcome under existing rates. Frank admission of this wins the confidence of the "prospect" and paves the way toward securing the business during later devolpment of the plant. Central-station power may be installed for a minimum investment, its reliability and flexibility are pre-eminent, and money put into isolated plants can usually be invested with greater profits elsewhere—points often unappreciated. Central stations should emphasize the true value of power service in their advertising. Statements that electric power will save money for the manufacturer should not be made until after each case is thoroughly investigated. The customer will be far more interested if a method can be shown him for making more money without increasing his costs. The central-station representative should be well versed in the reasons which make differences in rate schedules imperative.

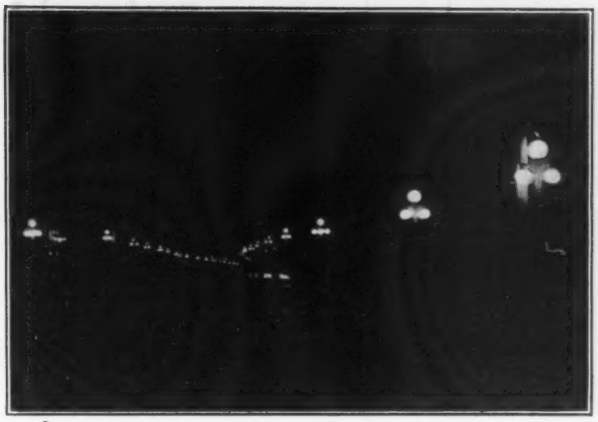
The Personal Factor

Mr. Eells pointed out that many isolated plants operated by large power users render high-class service, and that efficiency of operation is frequently made subservient to personal relations between officers and employees. Pride in owning a plant is not uncommon, and confidence in one's own figures often renders the central-station advance difficult. In view of the enormous radiation losses with steam heat, the prospects of electric heating with its concentrated application are constantly growing brighter. In Maine short transmissions are required, seldom exceeding 30 miles, and in many instances large industrial establishments own or control hydroelectric plants from which central-station service is in a degree a by-product. In such cases "big business" has secured the central station. The author emphasized the importance of analyzing local conditions and of considering the effect of regulation, speed-control requirements, surplus water-power, control of steam flowage at different hours, and supplementary plant operation, in reaching a conclusion as to the economy of central-station power service in a given situation. Working with large power users in groups is desirable when possible, and there is an important field for the use of synchronous apparatus in large industrial plants to reduce investment in generating equipment.

Electricity Makes Possible "Quick Service" at Cotton Gin

Although cotton gins are operated for only a few months each year, the advantages of electrically driven machines in such establishments may be made a real business asset to gin owners. In Waco, Tex., the installation of motor-driven machinery in the cotton gin illustrated herewith has enabled it to specialize on "quick service," a factor which has been found of great value as a business getter. The total cost of electric energy per bale of cotton ginned last season in this gin was only 49 cents.

MOTOR-DRIVEN GIN AT WACO, TEX.



A GLIMPSE OF TUCSON'S MAIN STREET AFTER NIGHTFALL

TUCSON'S ORNAMENTAL LIGHTING

Widespread Civic Effects of Better Illumination for Arizona City's Business Section—Cost of Installation of System

The new lighting system recently completed at Tucson, Ariz., employs a No. 8 lead-covered cable carried in fiber conduit laid in concrete from the substation. The lamps are controlled from the substation switchboard by two 17-kva. and one 12-kva. Westinghouse constant-current regulator.

There are seventy-five of the five-lamp standards and the same number of single-lamp posts, and a number of combination poles are now being installed where the lighting company's posts interfered with the ornamental standards at street intersections.

The standards are placed at intervals of 120 ft., the five-lamp posts being set opposite each other, while the single-lamp standards are staggered.

The standards measure 13 ft. 6 in. high and are fastened by bolts to a concrete base. Each five-lamp post has a four-lamp arm 12 ft. above the curb and carrying four 60-cp., 6.6-amp., 2300-volt series-burning gas-filled tungsten lamps inclosed in 12-in. by 6-in. "Nuglass" globes. The top sockets of these posts each carry one 100-cp., 6.6-amp., 2300-volt lamp inclosed in 16-in. by 8-in. "Nuglass" globes. The same kind of lamp is carried by the one-lamp posts.

ONE OF THE ORNAMENTAL TUNGSTEN LIGHTING POSTS NEAR THE RAILROAD STATION

All costs for installing, maintaining and operating the system are paid by the city of Tucson.

The installation cost for five-lamp standards was $143.23 per standard, the proportionate cost being as follows:

	Percentage
Conduit, wire and terminals	60.0
Standards	26.2
Lamps and glassware	7.7
Labor and incidentals	6.1

The installation cost of the single-lamp standards was $101.76 per standard, which cost may be proportioned as follows:

	Percentage
Conduit, wire and terminals	61.3
Standards	28.4
Lamps and glassware	3.6
Labor and incidentals	6.7

The above costs do not include the transformer, station and current regulators, this portion of the installation having cost $2,389.25.

The maintenance expense is estimated as follows:

	Per Post Yearly
Lamp renewals, five-lamp standards	$4.12
Lamp renewals, single-lamp standards	2.00
Globe renewals	No estimate
Painting and miscellaneous	No estimate

The cost of energy for operating the lamps will be 5 cents per kilowatt-hour.

The top lamps of the five-lamp posts and the lamps on the one-lamp standards burn every night and all night. The other four lamps on the five-lamp posts are operated every night from dusk to 10.30 p. m. The lamps are turned on and off by patrolmen at the transformer station.

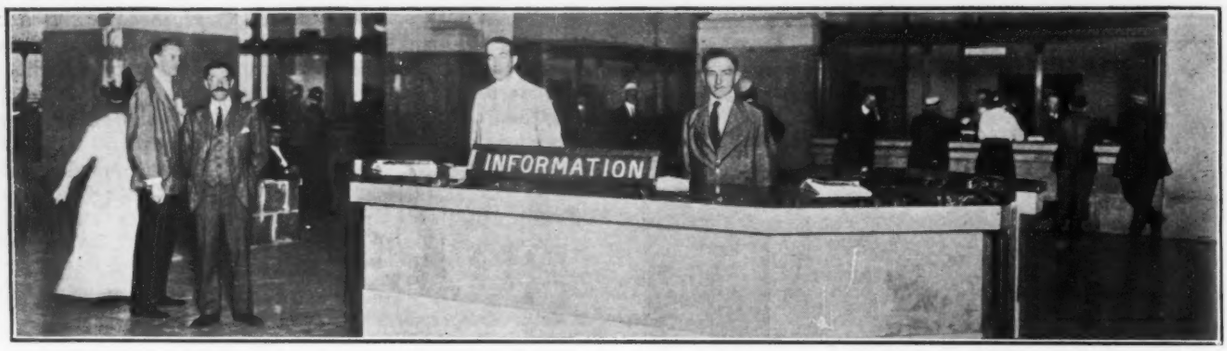
Some Indirect Results

The civic effect of installing this ornamental system has been highly satisfactory in every respect. Merchants are remodeling their windows to keep pace with the lighting improvements, more people now are out in the evenings, and fewer city patrolmen are needed.

The installation was made under the direction of the city's electrical engineer, John Whitestone, the design for the standards having been submitted by E. E. Russell of the Russell Electric & Machine Company, which supplied the equipment.

Rental-Paid Sweeper Presented to a Customer

An interesting innovation in the rental of vacuum cleaners has been introduced by a central station in a small Middle Western city, which commends itself in situations where missionary work is to be done and a bargain feature seems to offer a good influence. To introduce vacuum cleaners, this central station purchased a good cleaner of the sweeper type and advertised it for rent at $1 per day, stating that as soon as the machine had been rented a sufficient number of times, so that the rental income covered the purchase cost of the machine, the sweeper would be presented outright to one of the rental customers. It was explained that this proposition was being offered to give the public an opportunity to try the sweeper and become acquainted with its merits. A list was kept of all consumers who had rented the machine at any time, and when the cost of the sweeper was covered by the rentals one of these names was chosen by chance and the sweeper presented to this customer with the compliments of the company.



"CUSTOMERS' HALL" IS THE APPROPRIATE DESIGNATION GIVEN TO THE HANDSOME GENERAL OFFICE OF THE COMMONWEALTH EDISON COMPANY, CHICAGO, WHERE THE RECEPTION AND DIRECTING OF THE PUBLIC IS THE PARTICULAR DUTY OF A TRAINED STAFF

From the Customer's Viewpoint

The Attitude of the Man Who Gets the Business

The representative of the electric power company had just left the manager of a large manufacturing enterprise. The manager swung around and said: "What a pity it is for any man to send out salesmen whose individual personality actually misrepresents him! This young man came to tell me about this power proposition, and as I listen to him and watch his face as far as I am concerned he is that company. His manner, his attitude, his spirit either repels or inspires me with confidence not for him as a man but for the company that sends him and the service that he advocates. In this case the man knows his business and I am glad to go into the matter with him, but the chap they sent before was the other kind—both manner and appearance were against him. I simply would not waste my time with him, no matter whom he spoke for, and so he failed."

The Manager Who Accepted the Other Man's Viewpoint

"Quite a change in the office of our lighting company," said a boarding-house keeper in a small Southern town. "I like to go there now. I've been without electric light for some time merely because I was prejudiced by something that happened to me when the former manager was here.

"I was having trouble with my lighting. Something was wrong so that the lamps flickered in the different rooms, and my boarders were complaining. I received two telephone promises from the company that the case would be looked into immediately. Finally, at the end of the week, I called at the office. I spoke to the clerk at the counter, and he referred me to the former manager. He was sitting at his desk with a cigar in the corner of his mouth. I explained my case — a houseful of boarders, dim and flickering lamps, and my wish to get something done at once. The manager looked me over as though doubting my word and then said, 'We'll get to it as soon as we can.'

"I had received two promises like this and asked for a more definite time. The manager took out his cigar and said, 'All I can say is that we'll get to it as soon as we can.' He didn't see my side at all. Finally I said that unless the case were fixed up that afternoon I'd get along without electric light. 'All right,' said he, drawing a blank card toward him; 'we'll disconnect if you say so.'

"Compared with the present methods, this story seems out of reason, yet it's true. I signed the disconnect blank and have only renewed after a change in management. The new manager has a way of shaking hands that makes you feel when you have a complaint that about half the trouble is your own."

Is This Farm on the Lines of Your Company?

A well-to-do business man established a farmhouse in a town which shall be nameless. His farm was his hobby, and he was interested in making it as modern in equipment as such an "agriculturist's" place can be. One week-end a friend of his, an electrical engineer, visited him. He naturally expressed his surprise when he found that his farmer acquaintance was not lighting his house and barn, pumping water, cutting and handling his stock feed and so on by electricity. "I want to" was the answer that the farmer made, "but the manager of the central station nearest me isn't interested, and I don't want to bother with making my own electricity." "You leave it to me," said the engineer, "and I'll write and explain the situation to him."

The engineer was as good as his word. He wrote the president of the company, and some time later received an answer saying that his earlier letter had been forwarded to their manager, and that the manager's reply was that the farm was situated so far from the company's lines that it would not pay to run a line to get the load.

A week or two afterward the engineer called on his friend again. "Well," he said, "I suppose you've had a call from the manager of your central station and know the worst." His friend was puzzled. "I thought you probably forgot all about it after you left," was his unexpected answer. "I haven't seen our friend, the central-station manager, although since I saw you last I've been figuring out several more ways we could use electricity here."

The engineer told us this story. He thinks it quite possible that the central-station manager may be right. But he is equally sure that the case is at least worth his investigation. He knows his friend is ripe to spend the money for the convenience and certainty of electricity for power and light. He believes that along the transmission line leading to his friend's house there would be other farmers who would be interested in getting power if they were approached. He wonders how much unconnected load like this is awaiting at least an investigation as to its possibilities not only on this but on other lines.

A Contractor Who Shows a Personal Interest

The influence of a little personal interest from the "boss" is just about the least expensive and most profitable service that a contractor can offer to his patrons. There is a man in a Western city who has built up a contracting and merchandising business that is making him rich in both friends and money, and the basis of it is his habit of dropping in on customers where work is under way and saying, "Well, are they taking care of you and making you entirely satisfied?" He makes it a custom to show a personal interest in every job, but in each case it is his eagerness personally to please the customer himself that wins him friendships and more and better business. He accentuates the service feature by a show of interest that is not forgotten soon.

Technical Advance in Theory and Practice

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

MEASURING ONE-MILLIONTH OF AN OHM

Adapting Simple Apparatus to the Detection of the Most Minute Differences of Resistance—The Use of the Wheatstone Bridge and Kelvin Double Bridge for Verifying Precise Measurements

An interesting paper read by E. H. Rayner before the Physical Society in London gives useful hints for the comparison and measurement of resistances to a higher degree of accuracy than is usually attempted, although using, at the same time, very simple apparatus. Among other points raised, it is suggested that the accurate determination of the temperature coefficient of alloys might form a sensitive test, and one quickly carried out, of the chemical and physical similarity of such alloys.

The first part of the paper deals with the comparison of nearly equal resistances. This measurement shares with the comparison of nearly equal weights and lengths the capability of being carried out with the highest

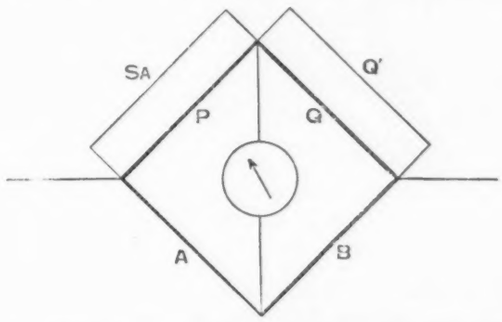


FIG. 1—SIMPLE ARRANGEMENT TO FACILITATE ACCURATE RESISTANCE MEASUREMENT

accuracy attainable in any physical measurement. Differences of one part in a million may generally be easily detected between resistances of not less than 1 ohm. It is essential for satisfactory work that they should be capable of carrying a reasonably strong current. As shown in Fig. 1, the two resistances are made part of a Wheatstone bridge $A\,B$, the other two sides, $P\,Q$, being nearly equal resistances, which may or may not be of the same nominal value as A and B. In the latter case A and B should be in series with respect to the supply current, as this allows the largest current to pass through the bridge and is, therefore, the most sensitive arrangement. It is also the most convenient. Balance is obtained by shunting one of the resistances with a relatively high resistance.

An Expedient When a High-Resistance Shunt Is Lacking

If the bridge is nearly balanced without a shunt, a very high shunting resistance—perhaps 100,000 or 1,000,000 ohms—will be required. This is very seldom obtainable. The difficulty can be got over by shunting one of the other arms, say Q, by any convenient resistance Q', whose value is not required to be accurately known, so that the required shunt on P is of convenient dimensions. It has the advantage that the variable resistance is always connected to the same part of the bridge, which conduces to ease and quickness of working. Thus, suppose that S_a is the shunting resistance required in parallel with P when A is connected to P, and S_b the shunting resistance when B is next to P. If P/S_b and P/S_a are small compared with unity, the author shows that $A/B = 1 + \frac{1}{2}P(1/S_b - 1/S_a)$. Thus $P = Q = 50$ ohms, Q being shunted by a fixed resistance Q' of about 9000 ohms. $A = B = 20$ ohms. $S_a = 8572$ ohms. $S_b = 8493$ ohms. $A/B = 1 + (25 \times 0.00000108) = 1 + 0.000027$. Thus it will be seen that a difference of 80 ohms in the value of the two shunting resistances corresponds to a difference of twenty-seven parts in a million in the ratio A/B, and as this difference may often be observable to 0.2 ohm or 0.3 ohm, the ratio of A to B may be determined to a few parts in 10,000,000 when A and B are nearly equal. It will be noted that absolute accuracy in P or in S_a and S_b is not required, except that the difference between S_a and S_b should not be seriously in error.

The second part of the paper discusses the comparison of resistances of different magnitudes. The author describes the verification of the potential divider, the construction and use of the Kelvin double bridge and a special form of Kelvin bridge for verifying the resistances used in precision alternating-current measurements. The paper is printed with illustrations, although somewhat abstracted, in the London *Electrician*, Sept. 10, 1915.

Generation, Transmission and Distribution

Water-Powers in Prussia.—BR. THIERBACH.—An article on a recent German government publication on statistics of the water-powers of the mountainous and hilly districts in Prussia. The area covered by the statistics is 91,800 sq. km., or about one-quarter the whole area of Prussia. There is available in this district 1,800,000 hp. of water-power, of which only 450,000 hp. has been developed, while 1,350,000 hp. remains still to be developed. The author discusses under what conditions this can be done economically, and shows that these conditions are fulfilled in many cases.—*Elek. Zeit.*, July 8 and 15, 1915.

Operation of Diesel Engines on Tar Oil.—HANS SCHMIDT.—Since the oils of the Galician oil fields are no longer available on account of the war, it has become necessary in Austria-Hungary to operate Diesel engines with tar oil. The author discusses the fundamental principles of the change, and thinks that after the war is over and Galician oils become again available, tar oil will still be retained for the operation of Diesel engines. —*Elek. u. Masch.* (Vienna), June 6, 1915.

Generators, Motors and Transformers

Speed Regulation of Induction Motors.—F. W. MEYERS.—An illustrated article on the use of induction motors compensated by double rectifiers. This combination resembles the behavior of direct-current shunt motors. Fig. 2 shows the arrangement. M is the induction motor, which is fed from the three-phase network N. The stator E_m has besides the main winding A (which carries the energy current) an artificial winding S for the magnetizing current for regulation. For

the sake of field compensation and for the additional problems of speed regulation the double rectifier G is provided, the half G_1 being connected to the stator and the other half G_2 to the rotor. They act in series on the direct-current network N_0. The windings of the motor

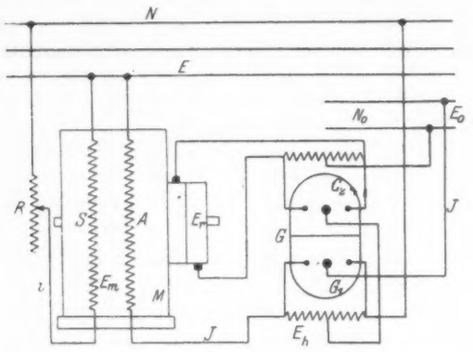


FIG. 2—WINDINGS OF INDUCTION MOTOR USED WITH DOUBLE RECTIFIER

are shown in the diagram for only one of the three phases. The theory of this arrangement is given, together with test curves. In order to simplify the construction, only one winding may be used for both the watt current and the magnetizing current in the stator and the two circuits kept separate only as far as neces-

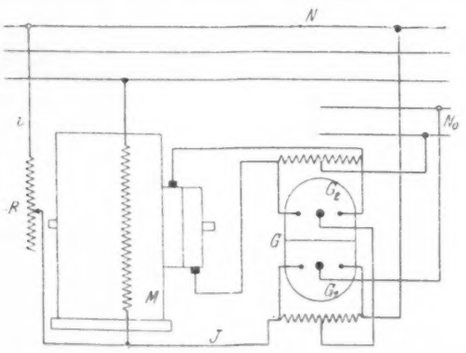


FIG. 3—ARRANGEMENT WITH SAME WINDING FOR THE WATT AND THE MAGNETIZING CURRENT IN STATOR

sary for regulation purposes. This is shown in Fig. 3, where the regulation takes place at R.—*Elek. Zeit.*, July 8 and 15, 1915.

Traction

Electric Railway in Sweden.—Sweden, which has few coal deposits but is rich in water-powers, has electrified the main railway from Kiruna to Riksgransen, a length of 130 km. (78 miles). The single-phase system is employed and water-power is utilized for generating the current. The voltage for transmission is 80,000 and the voltage on the trolley wire 15,000. The power plant contains three single-phase alternators, each of 10,000 kva., for the railroad, and one three-phase generator of 11,000 kva. supplying energy for the operation of the mines.—*Elek. Zeit.*, Aug. 5 and 12, 1915.

Wires, Wiring and Conduits

Laws and Regulations on the Distribution of Electrical Energy.—Uytborck.—A summary of the different laws and regulations on electricity supply in England, Germany, France, Italy, Spain, Sweden, Norway, Japan, Canada, Holland and Belgium.—*Bulletin Mensuel de la Soc. Belge des Elec.*, Vol. 30, page 429. A German translation in abstract by R. Rinkel in *Elek. Zeit.*, July 8, 1915.

Electrophysics and Magnetism

Roentgen-Ray Tube.—Ernest Rutherford and J. Barnes.—Two papers giving the results of an extended experimental investigation of the Coolidge Roentgen-ray tube. The first paper deals with maximum frequency of the Roentgen rays from the Coolidge tube for different voltages, the second part with the efficiency of production of Roentgen rays from the Coolidge tube. The authors found that the voltage required to excite the most penetrating rays in tungsten is about twice that to be expected on the quantum theory, indicating that about half of the energy of the exciting electron can be transformed into radiation. From the low value of the efficiency at high voltages—viz., about 1/500—it is clear that, on the average, one electron only in 200 is efficient in producing radiation.—*Philos. Mag.*, September, 1915.

The Magnetostriction and Resistance of Iron and Nickel.—C. W. Heaps.—An account of experiments which were undertaken with the object of making simultaneous measurements of magnetostriction and resistance in the same specimens of iron and of nickel. The importance of making different experiments on the same specimen is evident when a comparative study is to be made. The galvanomagnetic properties of a metal are so intimately connected with the other properties, such as purity, hardness, crystalline structure, etc., that results of different investigators using different samples cannot be compared with each other with any degree of exactness. In the author's experiments the specimen of iron was found to contract when magnetized either transversely or longitudinally. The specimen of nickel contracts in the direction of a magnetic field and expands perpendicularly to the magnetic field. For a longitudinal field the magnetostriction and resistance curves are found to be very similar—in iron the resistance increase is proportional to the contraction. For a transverse field the magnetostriction and resistance curves of nickel are very similar, showing a close relationship between the two effects. In iron the relationship is also evident, but is more complex than in the case of nickel. A decrease of resistance is associated with a diminution of magnetostriction, and an increase of resistance with an increase of magnetostriction. Except with iron in a transverse field contraction is always coupled with an increase of resistance, and expansion with a decrease of resistance. Application of the electron theory to the experimental results is as satisfactory as could be expected, though ignorance of the laws governing intermolecular actions in different metals prevents to a considerable extent thorough testing of any theory.—*Phys. Review*, July, 1915.

Units, Measurements and Instruments

Mercury-Type Electrolytic Meters.—R. Bossom.—The author refers to the ease with which electrolytic meters can be used for checking other meters *in situ* and their advantages in certain kinds of work, such as the testing of primary cells for ampere-hour output. Some notes are given on the testing of such meters in quantities.—London *Electrician*, July 9, 1915.

Predetermination of Instrument Magnets.—Kenelm Edgcumbe.—An article on the design of magnets for instruments. The work which has been done in connection with the magnetic circuits of generators and motors is of little use in this connection, since the fundamental requirement in that case is maximum flux compatible with moderate weight, whereas for instrument magnets it is the value of the hysteresis which is the determining factor, a maximum being required for permanent magnets and a minimum for electromagnets. The author discusses in detail graphical methods for the predeter-

mination of the residual flux in magnets.—London *Electrician*, July 16, 1915.

Distributed Capacity of Single-Layer Solenoids.—J. C. HUBBARD.—An abstract of an American Physical Society paper. The period of oscillation of circuits consisting of a single-layer solenoid and an air condenser has been precisely measured by a method devised for the purpose by the author. One of the objects of the measurements has been to determine the effective, or so-called distributed, capacity of solenoids, special attention being paid to the independent variation of all the factors upon which that quantity might depend. These are the diameter and axial length of the solenoid, the number of turns, the diameter of wire, and the dielectric effect of the insulation and of the core. The distributed capacity of a single-layer solenoid measured in electrostatic units is found to be a number of the same order of magnitude as the radius of the coil, measured in centimeters, but it shows relatively very slight variation with the axial length, number of turns and diameter of wire.—*Phys. Review*, July, 1915.

Curves for Designing Inductance Coils.—PHILIP R. COURSEY.—An article on the calculation and design of inductance coils such as are required in radiotelegraphy. Besides the fundamental formulas, the author gives two curve sheets which facilitate the calculation of such coils and numerical examples illustrating the use of the curves.—London *Electrician*, Sept. 10, 1915.

Telegraphy, Telephony and Signals

Automatic System for Transmission and Retransmission of Baudot Signals.—JOVENE MARCEL.—An illustrated account of the Taccani telegraph detector used in connection with Baudot apparatus, modifying the conditions of work of the employees and increasing their efficiency and the potential utilization of the line.—*Journal Telegr.* (Berne), June 25, 1915.

Alternating-Current Cable Telegraphy.—EDWARD RAYMOND-BARKER.—With reference to Squier's recent paper, the author gives an account of some work of his own on cable telegraphy. Apart from devising two forms of electromagnetic transmitter for the transmission of two-power alternating-current impulses as advocated by the late Mr. Gott, he has investigated especially two problems—first, how to cause two-power alternating-current signals to be registered in the usual familiar siphon-recorder code; second, how automatically to retransmit two-power alternating currents from one cable into another.—London *Electrician*, July 9, 1915.

Trench Telephones.—T. F. PURVES.—An illustrated article on special portable telephone equipment for use in trench warfare.—*Post Office Elec. Engrs'. Journal* (London), July, 1915.

Wireless Telegraphy.—M. BAVLOVSKY.—A mathematical note on the theory of the coupling of oscillating circuits not tuned to each other.—*La Lumière Elec.*, June 5, 1915.

Wireless Telegraphy in a Certain Direction.—E. BELLINI.—An article illustrated by diagrams describing some fundamental arrangements of the antennas for wireless telegraphy for the purpose of sending messages in a certain direction only. The fundamental equations are given.—*La Lumière Elec.*, July 3, 1915.

Radio-Frequency Changers.—ALFRED N. GOLDSMITH.—A paper read before the Institute of Radio Engineers in New York in which the author deals with the various frequency changers that have been proposed for use in radiotelegraphic stations, including the static method, the Goldsmith alternator, and methods dependent upon the arc electrolytic rectifier and transformers. The paper is to be concluded.—London *Electrician*, July 2, 1915.

Automatic Telephone Exchanges.—A. KRUCKOW.—An illustrated description of the technical equipment of, and the commercial results obtained with, small automatic telephone exchanges for agricultural districts.—*Elek. Zeit.*, July 8 and 22, 1915.

Direction Finder.—E. BELLINI.—An illustrated article on the Bellini-Tosi radioganiometer, which permits the determination of the direction of a wireless transmitting station. The author describes how this instrument has been developed more recently for practical use by the Marconi company.—London *Electrician*, Aug. 27, 1915.

Book Reviews

PLANE GEOMETRY. By Claude Irwin Palmer and Daniel Pomeroy Taylor. Edited by George William Myers, Ph.D. Chicago: Scott, Foresman & Company. 228 pages, illustrated. Price, $1.

In this book the material is so arranged that a concrete, experimental and somewhat informal approach is given to the subject of plane geometry. Experimental methods tending to vitalize the text are employed in the earlier pages, and as the student is assumed to progress inductive methods of presentation are employed. The usual formidable arrays of definitions, axioms and principles composing the first few pages of most texts are omitted. Care is taken in introducing the subject to cause the student to appreciate its worth and to obtain an insight into the meanings of the tasks presented. The book is one that presents the subject not only as a system of mathematical thought, but also as a matter of vital interest to the growing intellect.

THE YEAR BOOK OF WIRELESS TELEGRAPHY AND TELEPHONY. Prepared by the Marconi Publishing Corporation, New York and London. 800 pages, illustrated. Price, $1.50.

The 1915 edition of this year book follows closely the arrangement of material given in previous editions, except for revisions and expansion of contents. Included in the new material in this edition are articles on "Wireless and War at Sea," by Archibald Hurd; "The Influence of Wireless Telegraphy on Modern Strategy," by Col. F. N. Maude, and "Wireless Telephony," by H. J. Round. A brief record of the laws and regulations governing the operation of stations, as agreed upon at the international radiotelegraphic convention of 1912 and at the international conference on the safety of life at sea of 1914, is given. A list of the wireless-telegraph stations of the world, both land and ship stations, is also included, together with their call signals, normal ranges, wave-lengths, nature of service, ownership, hours of service and message charges. The whole field of radiotelegraphy and radiotelephony is thus covered.

Books Received

Alternating-Current Work. By W. Perren Maycock. New York: Macmillan & Company. 416 pages, 258 illus. Price, $2.25.

The Electric Railway. By A. Morris Buck. New York: McGraw-Hill Book Company, Inc. 390 pages, 192 illus. Price, $3.

Specification and Design of Dynamo-Electric Machinery. By Miles Walker. New York: Longmans, Green & Company. 648 pages, 533 illus. Price, $10.

B. G. LAMME

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Benjamin G. Lamme, who, with Frank J. Sprague, has been appointed to represent the American Institute of Electrical Engineers on the Naval Advisory Board, as already noted in these columns, was born on a farm near Springfield, Ohio, and was educated in the country schools of that vicinity. Later he entered the Ohio State University and in 1888 was graduated with the degree of mechanical engineer. In May, 1889, he entered the employ of the Westinghouse Electric & Manufacturing Company in its testing department, and soon afterward he took up design work, which he has followed continuously since. In 1900 Mr. Lamme was made assistant chief engineer, succeeding in 1903 to the post of chief engineer, which position he now holds. Mr. Lamme has been a leader in the development of alternating-current apparatus, including induction motors, polyphase generators, rotary converters and single-phase railway apparatus. He has also been a pioneer in the development of direct-current apparatus for railway, lighting and power work. Mr. Lamme has been an exceedingly fertile inventor, having to his credit a very large number of important patents covering electrical apparatus. Among the more prominent installations with which Mr. Lamme has been identified may be mentioned: the famous 5000-hp. revolving-field Niagara Falls generators installed in 1895; the design of single-phase motor and generator equipment for the New York, New Haven & Hartford Railroad; the Philadelphia-Paoli electrification of the Pennsylvania Railroad, and numerous other installations of importance.

W. F. Wallace of Twin Falls, Idaho, who was some time ago appointed receiver of the Great Shoshone & Twin Falls Water Power Company by Judge Frank S. Dietrich of the federal District Court, has just been elected vice-president and general manager of the Electrical Investment Company, and as such on Oct. 1 took over the direct management of the merger corporation as yet unnamed which will include the Idaho Power & Light Company, the Idaho Railway, Light & Power Company, the Idaho-Oregon Light & Power Company, and probably the Great Shoshone & Twin Falls & Southern Idaho Power Company. Of this merger the National Securities Corporation is the holding concern and the Electrical Investment Company is the temporary operating company.

Alten S. Miller of the firm of Humphreys & Miller, consulting engineers, New York City, has been retained by the Bartlett-Hayward Company, founder and engineer, Baltimore, Md., to assist the company with the large amount of work it has on hand. Through an error the statement was recently made in these columns that Mr. Miller had joined the organization of the Bartlett-Hayward Company. The connection is only of a consulting nature.

Dr. Michael I. Pupin, inventor of the Pupin loading-coil for long-distance telephone lines and of improvements in wireless telegraphy, has been granted a year's absence from his post of professor of electromechanics in Columbia University, New York City, and will

DR. M. I. PUPIN

devote his time to the interests of his native country, Servia, his work, however, not necessitating his return to that land. Dr. Pupin is the president of the Pan-Servian Alliance of the United States and is, as well, the honorary Servian Consul-General.

E. P. Chalfant has been appointed Eastern division manager for the Anderson Electric Car Company of Detroit, Mich., with headquarters in New York City. He was at one time connected with the Packard Motor Car Company as sales manager, and was also president of the E. R. Thomas Motor Car Company of Buffalo. Mr. Chalfant was recently secretary of the Electric Automobile Manufacturers' Association of Chicago.

FRANK J. SPRAGUE

Frank J. Sprague, appointed with Benjamin G. Lamme to represent the A. I. E. E. on the new Naval Advisory Board, was born at Milford, Conn., July 25, 1857. Winning a competitive appointment to the United States Naval Academy, he was graduated with honors in 1878, distancing both line and engineering corps in naval architecture. He early developed strong mathematical, constructive and inventive tendencies, and in 1880 attempted to introduce the electric light on the U. S. S. Minnesota. Failing to get to the Paris Electrical Exhibition, he got orders to the Crystal Palace (Sydenham, England) Exposition of 1881-82. Here he was the youngest member of a jury of awards made up of distinguished scientists, and made a complete report to the Naval Bureau of Intelligence. Ambitious to take up electrical work, he resigned from the naval service in 1883, with a year's leave, during which time he was an assistant to Mr. Edison in the early electric-light development and devised a mathematical system for determining the characteristics of central-station distribution. Resigning from Mr. Edison's employ because of his own developments in electric motors, he founded in 1884 the Sprague Electric Railway Motor Company, made a notable exhibition at the Philadelphia Exposition, and actively began the commercial application of electric motors to all kinds of stationary work. He installed on the U. S. S. Chicago the first electrically trained gun in the service. He soon began developments in electric railways along lines originated while abroad, and there followed the construction under his direction of the first typical electric trolley railway in the United States, that at Richmond, Va. Later he founded the Sprague Electric Elevator and Sprague Electric companies, and introduced electric high-speed and house elevators in competition with hydraulic elevators. In 1895 he invented the multiple-unit system of electric train control, for increasing traffic capacity, now used on all elevated and subway roads here and abroad, and in all electric train operation where two or more locomotive units are under common control. He is the inventor of a system of control

for the automatic braking of trains when violating signals, and is also concerned in the development of high-angle-fire shrapnel. Mr. Sprague is now consulting engineer for the Sprague, Otis and General Electric companies. He served as a member of the terminal electrical commission of the New York Central Railroad and as consulting engineer for the Southern Pacific Company on its proposed Sierra Nevada electrification. He is also vice-president of the Sprague Safety Control & Signal Corporation, which is engaged in developing his system of automatic train control. He was awarded a gold medal at the Paris Exposition in 1889, the Elliott Cresson Medal by the Franklin Institute in 1904, and a grand prize at the St. Louis Exposition in 1904 for his inventions and developments in electric railways, and the Edison Gold Medal by the American Institute of Electrical Engineers, 1911, for meritorious achievements in the electric arts. Mr. Sprague is a member and past-president of the American Institute of Electrical Engineers, the American Institute of Consulting Engineers and the New York Electrical Society, and is vice-president of the Inventors' Guild. He is also a member of the American Society of Civil Engineers and the English Institutions of Civil Engineers and Electrical Engineers, and an associate member of the Society of Marine Engineers and Naval Architects. He is a member of the University, Century, Engineers', Bankers' and City Lunch Clubs.

E. G. Robinson, the president-elect of the Northwest Electric Light & Power Association, is the general manager of the Jim Creek Water, Light & Power Company, Inc., of Arlington, Wash. Born at Memphis, Tenn., Sept. 12, 1875, Mr. Robinson attended the Memphis Military Institute, the University of Tennessee, and later Leland Stanford University, California, receiving the degree of B.S. in electrical engineering from the last-named institution in 1897. For the next year Mr. Robinson engaged in electrical construction work and then went to the Klondike, Yukon Territory, where he spent four years in electrical and steam engineering work, installing many isolated plants and serving as chief electrician for the Dawson Light & Power Company. In 1902 he left Dawson to settle in Seattle, later becoming superintendent of the Ballard Electric Company, which had taken over a defunct municipal plant. This plant Mr. Robinson rebuilt and put on a sound financial footing, but soon resigned his position to become superintendent and manager of the Skagit Improvement Company of Sedro-Woolley, Wash. Eighteen months later he was appointed manager and engineer of the Jim Creek Water, Light

E. G. ROBINSON

& Power Company, which position he now holds, although he continues to act as consulting engineer for the Skagit Improvement Company. Mr. Robinson is a charter member of the Seattle Section of the A. I. E. E. and has been active at the conventions of the Northwest Electric Light & Power Association from its inception. Besides acting on various committees, he served for the last two years prior to his election as vice-president for Washington of the Northwest Association.

C. L. Oechner, publicity manager of the British Thomson-Houston Company, Ltd., of Rugby, England, who was for many years with the Thomson-Houston Company at Lynn, Mass., and with the General Electric Company at Schenectady, N. Y., is now on an extended visit to the United States. Mr. Oechner plans to travel from Boston to California, and can be addressed while in this country in care of the ELECTRICAL WORLD, New York.

T. Takahashi, chief engineer for the Government General of Taiwan, Formosa, is now on a visit to the United States to attend the International Engineering Congress at San Francisco. While here Mr. Takahashi plans to inspect engineering works, especially those of a public character, and wishes to meet manufacturers of structural materials.

E. M. Rhett has resigned as chief electrical engineer for the Central of Georgia Railway, with headquarters at Savannah, Ga., in order to accept a position with the Du Pont de Nemours Powder Company of Wilmington, Del. Mr. Rhett is a graduate of West Point and served for a time with the engineer corps of the United States Army. Following this he was employed by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., and for several years past has been with the Central of Georgia Railway, engaged particularly in the design and construction of the company's new shops at Macon and Savannah.

G. Wilbur Hubley, who resigned recently from the Louisville (Ky.) Gas & Electric Company, had served for more than twenty years as chief engineer and superintendent of public service properties in Louisville. Mr. Hubley was prior thereto connected with the Westinghouse Electric & Manufacturing Company and also with the Citizens' Traction Company of Pittsburgh, Pa. In the foregoing connections his experience embraced construction and operation of plants and also the management and organization of properties. He had charge of the complete electrical installation of the Terre Haute (Ind.) street railway, which was one of the first electric railways in the country to be converted to electric traction. At Louisville he supervised the construction of a new 20,000-kw. steam-turbine plant and a 5000-kw. substation and the installation of a complete system of underground distribution subways. Mr. Hubley is a member of the American Institute of Electrical Engineers and is a past-president of the Engineers and Architects' Club of Louisville. As chairman for the State of Kentucky he was a member of the organization committee of the N. E. L. A. Some time ago he presented a paper on "Transformer Losses" before that body.

Obituary

James S. Grant, former superintendent of the Cumberland (Md.) electric-lighting system, died at Cumberland, Sept. 21, at the age of eighty-four.

William Riley Pope, electrical engineer of the National Conduit & Cable Company, Hastings, N. Y., died Sept. 16 of apoplexy. Mr. Pope was born in 1856 at Lake Roland, Md. He is survived by his widow and a daughter.

John W. Bookwalter, who retired some years ago as the head of Leffel & Company, manufacturers of water turbines, Springfield, Ohio, died Sept. 27, at San Remo, Italy. Mr. Bookwalter was seventy-seven years of age and was a pioneer in the application of water-wheel apparatus. For the last fifteen years he had lived abroad.

William Dulles, president and director of the Dulles-Baldwin Electric Drill Company, died at Fishers Island, N. Y., Sept. 14, at the age of fifty-seven years. Mr. Dulles, who was born in Philadelphia, was a graduate of Princeton University, class of 1878. In 1883 he came to New York and engaged in the practice of law, later becoming prominently identified with many manufacturing interests.

S. C. Walker, vice-president and secretary of the Erie County Electric Company, Erie, Pa., whose death, following a long illness, was recorded in these columns last week, was also vice-president and director of the Erie News Publishing Company, and first became identified with the Erie County Company in 1896. He was born at Peekskill, N. Y., forty-nine years ago and received his early training at the Peekskill Military Academy. Before coming to Erie he had been identified with several engineering, electrical and contracting firms.

New Apparatus and Appliances

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Industry

Hinged Lamp Guard with Locking Attachment

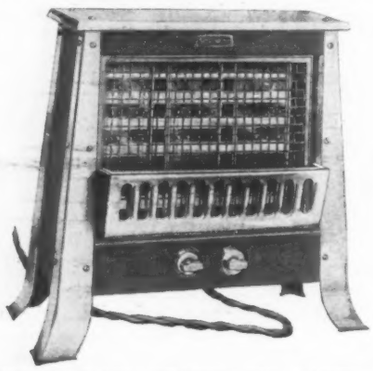
The lamp guard shown in the accompanying illustration is formed from two shells of expanded steel which are hinged together at the base and are fastened together at the socket by means of a special key-locking

STEEL-HINGED GUARD WITH LOCKING KEY

screw. The guards are being made for standard brass sockets with ratings of from 15 watts up to 60 watts. By means of the locking screw the guard can be adjusted to fit as tightly as desired, and when the screw is removed theft is prevented. The guards are packed nested, a dozen to the carton, the twelve guards weighing only 2 lb. The guards are being placed on the market by the Flexible Steel Lacing Company, 522 South Clinton Street, Chicago, Ill.

Radiant Electric Heater

As an outgrowth of the development of its luminous radiant heater, which is called the "El Radio," the Hotpoint Electric Heating Company, Ontario, Cal., has just brought out the unit shown herewith. While the "El Radio" was designed as a supplementary heater for small rooms, offices and bathrooms, the device illustrated herewith has been developed for heating large rooms. The heater is being made in two sizes, the smaller taking

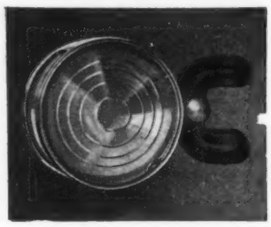


ELECTRIC RADIANT HEATER FOR LARGE ROOMS

600 watts to 1800 watts and the larger from 600 watts to 3000 watts. The device is of pressed steel and is trimmed in polished nickel. The larger heater has five elements and three indicating snap switches, allowing the use of either one, two, three, four or all elements. The smaller heater is equipped with three heating elements and two snap switches.

Electric Lamp for Horse-Drawn Vehicles

In the accompanying illustration is shown one of several types of electric lamps developed by the Rose Manufacturing Company, 910 Arch Street, Philadelphia, Pa., for use on horse-drawn vehicles. The "Neverout" lamps, as they are called, are equipped with various



VEHICLE LAMP GIVING REAR, FRONT AND SIDE LIGHT

types of brackets, so that they are suited, it is declared, for any purpose desired. The lamp illustrated is equipped with a so-called universal-clamp bracket, by means of which the lamp can be employed on either the right or the left side of the vehicle. It is of heavy-gage brass and gives a red rear signal light and a white side light for illuminating the curb or step. An "on" and "off" switch is provided at the rear of the lamp. Use is made of 3.5-volt or 6-volt, 2-cp. or 4-cp. bulbs. The lamp is operated by two dry cells.

Bowl-Type Steel Reflectors

Two 6-in. bowl-type diffusive reflectors designated by the manufacturer, Harvey Hubbell, Inc., Bridgeport, Conn., as No. 5860 and No. 5865, have recently been developed. The shades are designed particularly for industrial service, being adapted especially for bench work. The maximum efficiency is obtained when used with 25-watt and 40-watt lamps, the neck being so arranged that when the lamp is inserted a considerable radius is illuminated and at the same time the strongest light is concentrated directly beneath the unit. The No. 5860 reflector is finished with a heavy coating of porcelain enamel and is green outside and white inside. The No. 5865 unit is a painted shade and is finished green

STEEL-BOWL-TYPE REFLECTOR FOR 25-WATT AND 40-WATT LAMPS

outside and aluminum inside. The unit is especially adapted for installations where it will be subject to rough usage. The reflectors are of heavy steel and are equipped with contractile collars, making the use of separate shade holders unnecessary and assuring, it is declared, absolute center suspension. The collars are also of Harvey Hubbell make.

Decorative Lamp Stand

The lamp stand shown herewith is 5 ft. 6 in. high and is provided with a 14-in. base and a 20-in. shade and equipped with two pull-chain sockets. The shade is provided with lining in various colors, the lining being

WOODEN LAMP STAND

stretched on a loose-wire frame which may easily be taken out to change the lining if desired. The stand is of hard wood and finished in ivory-white enamel rubbed to a dull gloss with the fluting and parts of the shade finished in black lacquer. The stand is being placed on the market by the Crucet Manufacturing Company, 256 West Twenty-eighth Street, New York.

Electric Head Lamp for Bicycles

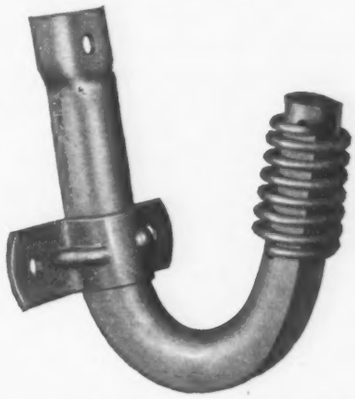
In the accompanying illustration is shown a battery-operated headlamp mounted on a bicycle. The device may be also utilized with vehicles, motorcycles and boats. It operates on one standard No. 6 dry battery and can be used for fifty hours. The headlamp can be so adjusted that the ray of light may be thrown in any direction desired, throwing a beam of light, it is claimed, for a distance of 200 ft. The device is constructed

BATTERY-OPERATED LAMP FOR BICYCLE

throughout of brass and is finished in nickel. A black steel container is provided for inclosing the battery and is equipped with a clamp for attaching it to the frame of a bicycle or motorcycle. Weatherproof wire with terminals is employed for connecting the battery to the headlamp. The lamp is being made by the Usona Manufacturing Company, 1 Hudson Street, New York.

Pressed-Steel Bracket with Resilient Thread for Insulators

Pole-line brackets of pressed steel have recently been developed by Hubbard & Company, Pittsburgh, Pa. The Peirce bracket, as it is called, is of unusually strong

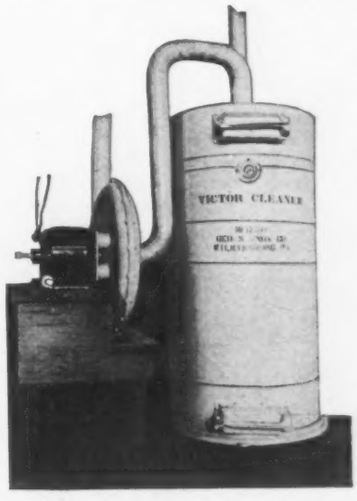


PRESSED-STEEL BRACKET WITH SPRING THREAD

construction, the manufacturer asserts, and is provided with rounded surfaces which cannot scrape the insulation from the wires. The bracket is equipped with a spring thread, as shown in the illustration, which, it is claimed, cannot lock the insulators. The spring thread yields and adjusts itself to the insulator.

Electric Stationary Vacuum-Cleaning System

In the accompanying illustration is shown a simple stationary motor-driven vacuum-cleaning apparatus made by the George S. Knox Company, 513 Pennwood Avenue, Wilkinsburg, Pa. A large tank (without a bag) is the dirt receptacle and, according to the manufacturer, it is only necessary to clean this about once a year. When operated by an 0.5-hp. motor, the machine displaces 170 cu. ft. of air per minute. The piping sys-



VACUUM-CLEANING SYSTEM WITH LARGE TANK WHICH NEED BE CLEANED ONLY ONCE A YEAR

tem utilized with this cleaner consists of 2.5-in. pipe with a 2-in. opening. The tank is usually placed immediately under the riser or as near to it as possible; the motor or fan, however, can be removed to quite a distance from the riser, in the laundry if desired, where it can be employed to operate other devices, such as washing machines, ice-cream freezers, etc. Only two

bearings are employed, and these require oiling about once every six months. The manufacturer claims that a machine operated by an 0.5-hp. motor is large enough for residences, while one driven by a 1-hp. motor will clean a ten-room school building or auditorium.

Overhead Protective Crossing Clamps

For the safeguarding of line crossings above railroad rights-of-way, telephone and telegraph lines, Edwin G. Hatch, 120 Broadway, New York, has developed the overhead straight-line crossing clamp and the angle

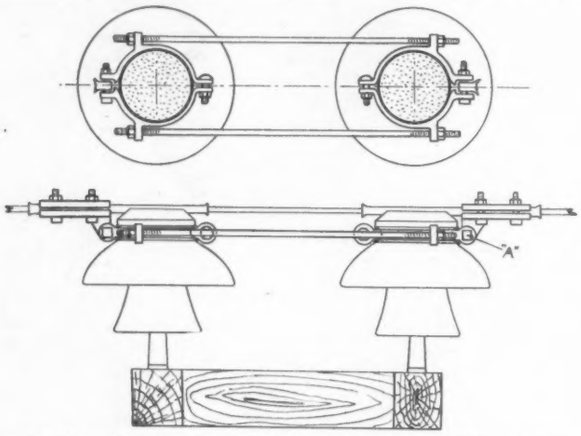


FIG. 1—OVERHEAD STRAIGHT-LINE CROSSING CLAMP

protective crossing clamp illustrated herewith. For straight-line crossings the clamps are pivoted at *A* (Fig. 1) so that the clamp will readily assume any vertical angle which the line takes without kinking the conductor. A slot is provided at *A* to give a small amount of motion and to keep the line in the top groove of the insulator, where the weight should be carried, allowing for any small variation in the size of the insulator heads. The steel tie rods provide easy adjustment, it is declared, in case of different spacing between the insulators. On account of the fact that the insulator necks are rarely true circles, and that the clamping bands bind at a few points only, thin lead strips are provided. The lead is plastic and distributes the strain over a greater surface, thereby preventing severe strains being imposed at a few points. The clamping bolts are made to straddle the line, in order

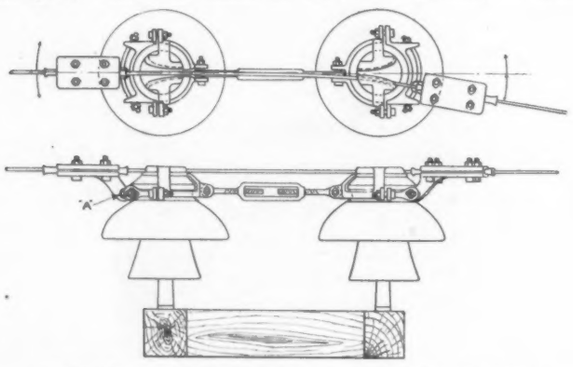


FIG. 2—ANGLE PROTECTIVE CROSSING CLAMP

to give the best possible clamping action, the line being protected by bushings in the clamping jaws. These jaws serve to protect the conductor in case of a flashover and act as arcing shields. For use where the line crosses at an angle the clamp shown in Fig. 2 is being employed. The clamp can be utilized with any angle up to 90 deg.

Rubber-Insulated Screwdriver

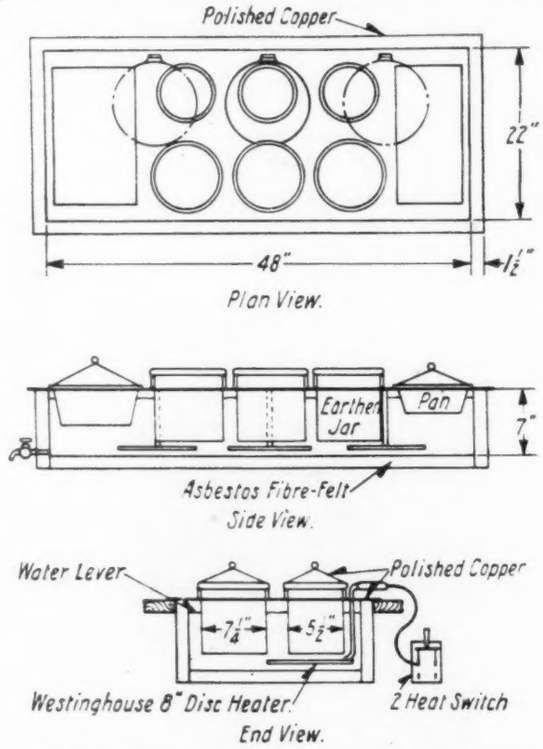
For use around automobiles, gas engines and electric apparatus where it is possible for one to receive electric shocks, H. D. Smith & Company, Plantsville, Conn., have

SCREWDRIVER WITH HANDLE COVERED BY RUBBER

put on the market a screwdriver such as is illustrated herewith, the handle being covered with a layer of black rubber. The blade length is 6 in. and the over-all length 11.25 in.

Electric Steam Tables for Lunch Counters and Restaurants

A steam table adapted for use with 8-in. disk-type immersion heaters made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is shown herewith. These heaters are designed for two-heat regulation and take 1100 watts and 275 watts. They are very thin and are especially well adapted for steam tables where the space between the food containers and the bottom of the tank is small. An ordinary gas-operated steam table may easily be changed over for electric operation by suitably insulating the walls and bottom with 1.5-in. asbestos felt and by installing immersion heaters as shown in the illustration. In operating the electric table it is advisable to fill it with warm water at the start, as in this case the three heaters may be used at low heat and the maximum demand on the table can be reduced to 825 watts. After the tem-

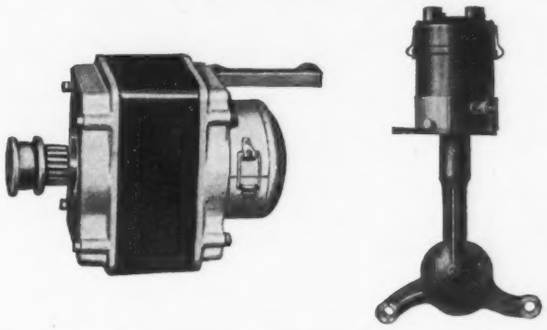


STEAM TABLE FITTED FOR ELECTRIC OPERATION

perature of the water reaches 180 deg. to 200 deg. Fahr., two of the heaters may be turned off, as one unit will maintain the temperature sufficiently high for ordinary conditions. Operated in this way for twelve hours a day, the energy consumption is about 7 kw.-hr. and the daily load factor about 35 per cent, making it very desirable business for central stations.

Electric Equipment for Ford Cars

An electric starting and lighting system to which an electric ignition apparatus may be added if desired has recently been developed for Ford automobiles by the Westinghouse Electric & Manufacturing Company, East



FIGS. 1 AND 2—ELECTRIC UNIT WITH BRACKETS, PINION AND FAN PULLEY, AND IGNITION APPARATUS

Pittsburgh, Pa. The system consists essentially of a single unit, which acts as starting motor and lighting generator, and a storage battery. When the starting switch is closed, the unit operates as a motor taking energy from the battery and driving the engine at a speed of about 175 r.p.m. When the car reaches a speed of 9 miles per hour on high gear, the unit is operated as a generator and provides energy for the lighting system and for charging the storage battery.

Use is made of the single-wire (ground-return) method of wiring, the frame of the car being utilized as the return circuit. With such a wiring system it is claimed greater clearance for insulation, ample size of contact parts, a small number of connections, low-voltage loss, and reduction of trouble on account of short-circuits are obtained. The unit is driven by an inclosed Morse silent chain, which is connected to a special shock-absorbing pinion. Use is made of ball bearings. At high speed the charging current tapers off so that the battery does not overcharge when touring. The windings of the electrical unit are given a special impregnation treatment, so that they will not be damaged by heat, water, gasoline or oil. The manufacturer points out that the winding can withstand a temperature of 250 deg. Fahr. without harm.

The vertical ignition unit is made up of an interrupter (timer) ignition coil and condenser and flat-

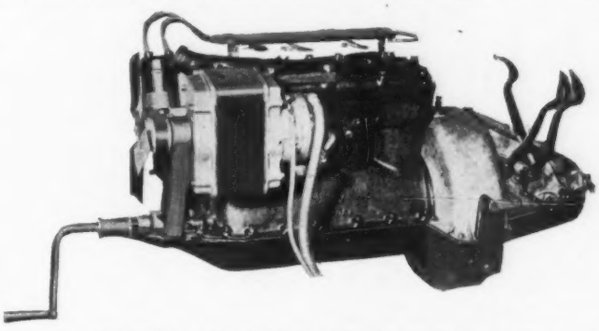


FIG. 3—STARTING, IGNITION AND LIGHTING SYSTEM ON FORD ENGINE

surface distributer. Energy is taken from the battery, only one wire from the dash being required. A circuit-breaker with platinum contacts is provided in the primary circuit for giving a spark in the cylinder at every power stroke. The ignition coil and condenser are given an impregnation treatment to withstand the effects of heat and water. They are inclosed in a tube of "bakelized micarta," which protects them from oil and gasoline. The core of the coil is of silicon steel. To direct the spark to the proper cylinder is the sole function of the distributer, the interrupter doing the timing.

Alternating-Current and Direct-Current Instruments

An interesting line of electric measuring instruments for both alternating-current and direct-current circuits, which, according to the manufacturer, the Weston Electrical Instrument Company, Newark, N. J., are meters

FIGS. 1 AND 2—WATTMETER FOR SINGLE-PHASE ALTERNATING CURRENT AND DIRECT CURRENT, AND POLYPHASE METER

of precision, is shown herewith. The instruments are guaranteed, it is declared, to have an accuracy of 0.25 per cent full-scale value on either direct current or alternating current of any frequency up to 133 cycles per second and of any wave-form. They can also be utilized, it is claimed, with any commercial frequency up to 500 cycles per second with slight error due to phase displacement. Double ranges are provided in all the instruments. The manufacturer points out that the meters are provided with movable systems which have low moments of inertia and which can be effectively damped, that indications are independent of room temperature, or the heating effect of the energy passing through the windings, and that they are shielded from external magnetic influences.

The scales are 5.25 in. long. Each scale is hand-calibrated and is provided with a mirror over which the knife-edge pointer travels. The pointers are equipped with simple zero setting devices.

In Fig. 1 is shown a portable electro-dynamometer

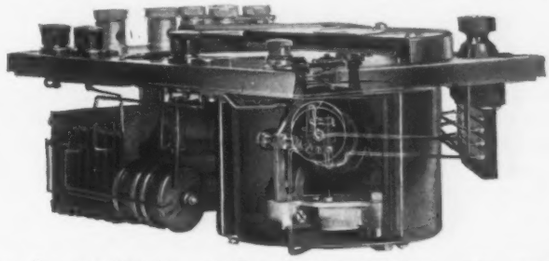


FIG. 3—SECTIONAL VIEW OF WATTMETER FOR DIRECT CURRENT AND SINGLE-PHASE ALTERNATING CURRENT

Model 310 wattmeter. Meters of this type are being made for both single-phase alternating current and direct current, and special types can be provided for circuits where the power-factor is very low. The instrument is inclosed in a mahogany case, 8 in. by 10.25 in. by 5.75 in., and the total weight is approximately 11 lb. A sectional and phantom view of the Model 310 watt-

meter is shown in Fig. 3. The Model 329 polyphase wattmeter illustrated in Fig. 2 is inclosed in a mahogany box, 9.5 in. by 10.5 in. by 8 1/16 in., and the total

FIG. 4—PORTABLE VOLTMETER

weight is approximately 17.5 lb. The scales of this type of meter are also uniform throughout.

A portable Model 341 voltmeter is shown in Fig. 4, and a portable Model 370 ammeter in Fig. 5. Both in-

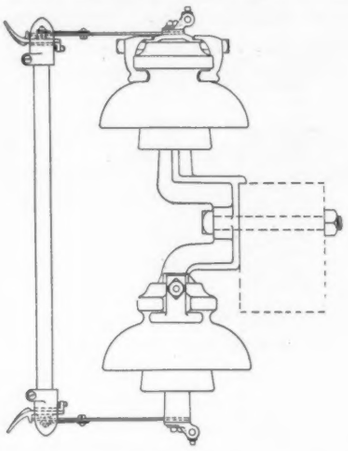
FIG. 5—PORTABLE AMMETER

struments are designed for use on direct current and alternating current. On account of the principle of operation of these instruments the scales are not uniform, although the upper four-fifths of the scales is quite uniform and legible. Both instruments are inclosed in mahogany boxes. The dimensions of both the ammeter and voltmeter are 8 in. by 10.25 in. by 5.75 in., and the weight is approximately 11 lb.

A Fused Transformer Cut-Out

A means of protecting distribution transformers, consisting of a fused tube mounted as shown in the accompanying diagram and attached to insulators which are supported by arch clamps, has recently been brought out by the Pacific Electric Manufacturing Company, San Francisco, Cal. The arch clamp permits the use of a "half hitch" in the line wire about the groove of the insulator, with electrical contact made by means of brass lugs, each of which is fitted with two sherardized set screws. These lugs securely bind the line wires after the "half hitch" has been made. The contact shoes are flexibly mounted on the tube-supporting arms, which are of brass reinforced in the fashion of a buggy spring. The shoes are shouldered just back of the flared tips which engage the adapters holding the fuse tubes. The adapters are of contact metal castings machined to fit the contact shoes. One-half of the casting is circular in form to engage the ferrules of the fuse tube, which is of "micalite," and, it is claimed, will not warp or deteriorate with age and is impervious to oil, water, light acids and ordinary solvents. The tube is fitted at both ends with knurled brass ferrules. The knurl in the ferrules binds two soft-lead disks, which firmly clamp the aluminum fuse wire without shearing.

A "silicone" filler is employed for the purpose of isolating the fuse wire from the walls of the tube. The fuse tube can be renewed and is made in any length up



FUSED EQUIPMENT FOR PROTECTING DISTRIBUTION TRANSFORMERS

to 40 in. Handles for clamping or releasing it are 6 ft. in length and are built in two types, one being solid and the other in two sections for convenience in carrying by a mounted patrolman.

Electric Washer with Swinging Wringer

The Horton Manufacturing Company, Fort Wayne, Ind., has just brought out its No. 32 electrically operated washing machine, the feature of which is the "three-way" wringer. The driving gears of the washer

DOLLY-TYPE ELECTRIC WASHER

are machine-cut, and noise and friction are therefore reduced to a minimum. The wringer is equipped with ball bearings and is reversible. An automatic safety device is provided to prevent injury to the operator. All exposed gears are covered, and the dolly is guarded so as not to tear the clothes. The motor is of Fort Wayne Electric Works make.

News of the Industry

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

MASSACHUSETTS CONTRACTORS CONVENE

Discussion of Relations with Central Stations and with Labor—Operation of License Law

Nearly 250 members and guests attended a convention of the electrical contractors of New England, under the auspices of the Massachusetts association, at Springfield, Mass., on Sept. 22 and 23, headquarters being at the Hotel Kimball. At the opening session President John R. Galloway of the National Electrical Contractors' Association, Washington, D. C., delivered an address depicting the evolution of the electrical contractor and pointing out the importance of engineering education in meeting present and forthcoming responsibilities. Abstracts of the papers and the discussions are given below.

Relations of Contractor with Central Station

Herbert A. Holder, Boston, Mass., presented the joint report submitted at the convention of the New England Section of the N. E. L. A. at Kineo, Me., Sept. 15-17, on the above topic. The author concluded with the opinion that it is the privilege and right of the central station to dictate to the wiring contractor the conditions which must be observed before the contractor's work can be connected to the system, but that beyond this the central station should not continue to take measures which may adversely affect the contractor's business. The paper averred that electrical contractors and dealers are now fully capable of taking over the entire handling of all installation equipments, and that they should be the sole final medium between the product of the manufacturer and the consumer.

Clifton R. Hayes, manager of the Fitchburg (Mass.) Gas & Electric Light Company, read a paper urging full consideration of mutual viewpoints and recalling some of the difficulties of contractors and central stations that are appreciated by each. The writer said that the contractor best flourishes in a territory served by a live, progressive electric company, and that the contractor serves himself as well as the central station when he secures new customers for the latter. In view of the mutual benefits, the author held that no ground exists for the contractor to consider something due him as recompense from the central station for the business turned in to the latter. The progress and prosperity of the electrical industry as a whole assure the contractor of his reward, and all interests are headed in the right direction. Much is to be gained by discussing local differences frankly, but the contractor should realize that the central station is a fundamental factor in the supply of electrical service and hence in the development of all related branches of the industry.

Discussion

L. R. Wallis, superintendent of the sales department, Boston, Edison company, emphasized the need of doing business systematically in large central stations. This leads to regulations often not appreciated by the contractor. The central station cannot treat its public with discrimination and hence has to work by rules. Small contractors, of whom there are so many, fail often to appreciate the need of system. The contractor can help the industry if he will turn in the names of persons inquiring for service or appliance information to the central station, so that they can be followed up and not overlooked as is often the case. New business at little cost would then be added to the contractor's portion. Many prospective customers want to see the man who is going to do their installation work, and in this there is a chance for team play. A general discussion then arose relative to the efficiency of handling orders in large companies, centering about the Boston organization. Several speakers urged the benefits of a policy which would enable a contractor rapidly to ascertain the exact status of each order for service at all times by telephone, while others held that this might cause confusion. A. J. Hixon, Boston, said that only a small percentage of service orders are likely to be delayed on any central-station system, and that special arrangements for tracing these delays might be made without serious difficulty. Fred H. Smith, Worcester (Mass.) Electric Light Company, said that in his company a girl is delegated to do this tracing work, and that the contractor should realize that the loss of earnings prior to the connection of the customer is a powerful incentive to the company to push applications for service through to immediate completion.

Status and Outlook of the Electrical Contractor

L. D. Gibbs, superintendent of the advertising department, Boston Edison company, addressed the convention on the conditions confronting the electrical contractor as a result of the passage of the Massachusetts electricians' license law this year. The effect of the law is toward the elimination of incompetent contractors and workers, from whom the qualified men have long suffered. "You have begun to cast off these barnacles," said the speaker, "but if you do not take care of them they will go into the submarine business. When you get rid of them many of the questions now perplexing you will disappear in the face of the great opportunities ahead in the electrical industry." Mr. Gibbs advocated doing everything possible to utilize the services of the men thrown out by the law, training them for useful work in the industry and giving them employment where possible. He advocated stiffening the examinations for licenses. On behalf of the New England Section of the N. E. L. A. Mr. Gibbs said that it would meet half the legitimate expenses of conferences between members of a joint committee representing central stations and contractors to discuss points of mutual concern. He urged the contractors to use the good offices of their friends in the central-station organizations to follow up the progress of orders. The companies stand ready to improve the handling of these wherever this proves possible.

The speaker suggested the opportunity for the smaller contractors to expand their business by employing bright young men as solicitors on a commission basis, plus a drawing account of, say, $5 per week for expenses. The influence of giving promising young men a start in this way will last long after the solicitor has left the employ of the contractor, assuming that he only stays a few months on his way forward. Another neglected opportunity is to call upon old customers of several years' standing to inquire about their satisfaction with the service, perhaps dropping in some evening with a new electrical device under one's arm which will arouse

interest as it is being taken to the contractor's own home. In reference to the Boston house-wiring campaign, Mr. Gibbs said that some contractors made the mistake of looking only at the basic figure of $14.35, representing the cost of wiring the initial outlet in the Boston campaign, and concluding from this that no money could be made from the proposition. About 3500 wiring contracts have up to the present been let in this house-wiring campaign at an average outlay of from about $80 to $90.

Massachusetts License Legislation Results

Alfred J. Hixon, Boston, presented a committee report on the results of the Massachusetts electricians' license law of 1915. The board of examiners has granted 650 contractors' licenses and 5000 workmen's licenses out of 700 applications for the former and 5500 for the latter. The report held that the law must be followed up to make it duly effective, first, by keeping in touch with the examiners, who are its administrators, and keeping them properly informed as to the true conditions to be met, and by strenuously following up all infractions, and, second, by collecting data for presentation to the next Legislature in connection with amendments required by experience. In the rush of business accompanying the inauguration of the law, the examining board was obliged to accept the sworn statement of the applicant for exemption from examination, but future applicants will be investigated in this connection. The examinations will also be made more difficult as time passes. Many unfit persons received licenses, which are subject to revocation in case of false statements. Thus journeymen's electricians' licenses have been applied for and granted to practically the whole of the motion-picture operators' union, members of which claimed that at least a portion of their livelihood is obtained by the installation of electrical work, and in the opinion of the committee these applications are deliberate perjury and misstatement. The law is a part of the criminal code and is enforcible by the local police authorities.

Discussion

In the discussion it was brought out that the board of examiners have referred to the Attorney-General the point whether a workman with a journeyman's license can take a contract. President Tuohey said that the contractors at Springfield are following the application of the law closely and have retained a man who is virtually a detective to run down violations. Other speakers pointed out the possibility of enlisting the aid of municipal wiring inspectors in bringing violators to book. J. P. Coghlin, Worcester, Mass., said that the inspector should have authority to require the workman to show his license in every case. There are no inspectors in small towns, and contractors must depend upon their own observation and information in such cases, and should not be too sensitive about reporting infractions of the law.

Relations Between Employers and Labor in Electrical Contracting Business

Robert H. Hallowell of the Lord Electric Company, Boston, Mass., in an inspiring address on the relations of capital and labor in the electrical contracting industry, said that arbitration is now conceded to be a better method of settling disputes than the strike or the lockout. Profit sharing is the most successful means of attempting to secure harmony, but it is not yet applicable to the building trades, where the hourly basis is the only practicable one for payment. Labor fluctuates in ability, and getting mutual points of view is most desirable. The Electrical Contractors' Association of Greater Boston, composed of equal representations of employers hiring union and non-union labor, has an agreement with the electricians' union providing for a permanent conference board of ten members, five from the employers and five from the union. This board has been successful beyond expectations, notably in securing a postponement of a wage increase agreed upon just prior to the opening of war in Europe, following conferences upon the condition of the industry subsequent to the inauguration of hostilities. Six months' notice in writing is required by either party in case a change in an agreement is desired. In closing, Mr. Hallowell said that in the maintenance of harmonious relations between labor and capital the objects of preparedness are advanced throughout the country.

L. W. E. Kimball of Boston, representing the International Brotherhood of Electrical Workers, addressed the convention upon co-operation, citing the work done by labor leaders and employers in securing the passage of the Massachusetts electricians' license bill. He then discussed the educational situation in Massachusetts with respect to the training of electricians, contending that the vocational schools are doing work inimical to the industry in permitting students to perform outside construction jobs in competition with licensed journeymen and contractors, particularly on public buildings. The speaker advocated establishing a ratio between the market for electrical labor and the number of students accepted in vocational and industrial electrical courses. The organization, he said, is not opposed to industrial training and education or to raising the standards of workmanship, but it desires that all productive work shall be done in the shop and that one-half day per week shall be devoted to the study of principles in the vocational school. A. J. Hixon, Boston, said that the problem was again one of getting the contractor's side before the public authorities, and, on motion of J. P. Coghlin of Worcester, a committee was appointed to investigate the subject.

Report of Code Committee

H. W. Kimball, chairman of the code committee, read a report outlining the history of the electrical code and pointing out the excellent relations now existing between the contractors' and other associations and the code makers. Uniform rules and uniform interpretation are most desirable for different localities. The proposed plan of having electrical materials tested at the Bureau of Standards, Washington, instead of by the Underwriters' Laboratories, was commended.

Resolutions Addressed to Electrical Examiners

A resolution addressed to the Massachusetts board of electrical examiners was passed asking that the interpretation of the meaning of "journeyman electrician" be not other than one working for a daily wage, and that it should not include the right as to barter and sale of material or labor other than as a daily wage. The resolution also urged that "gaining a livelihood" be interpreted to mean gaining the principal part of one's livelihood by the actual installation of electrical construction materials, and not the replacement or operation of moving parts of electrical apparatus. It was also recommended that the examination shall in part consist of a practical demonstration of the applicant's mechanical and electrical skill.

Election of Officers

At the annual business meeting the following officers were elected: President, Alfred J. Hixon, Boston, Mass.; vice-president, Charles W. Stiles, Milton, Mass.; secretary, Henry D. Temple, Worcester, Mass.; treasurer, Frank L. Barnes, Boston, Mass. The 1916 convention will be held at Hartford, Conn.

Multiphase Currents

Miscellaneous News Items Picked from the Happenings of the Industry

A Veteran Tungsten Lamp.—After burning almost continuously during the night hours for the last five years, a 100-watt tungsten lamp first put into service in a garage at Sonoma, Cal., early in 1910, has just been taken down with filament still intact. The lamp is estimated to have burned 20,000 hours, which, at 10 cents per kilowatt-hour, represents the consumption of $200 worth of electricity.

Make Electrical Connections Before Street Is Paved.—One of the latest steps taken by the President of the Borough of Manhattan, New York City, in his efforts to keep the streets of the city open to traffic is to have signs attached to the lamp-posts situated along the streets about to be paved reading as follows: "Notice.—Street openings required for water, steam, gas or electrical connections should be made at once, as this street is about to be paved and no pavement cut will be permitted for one year."

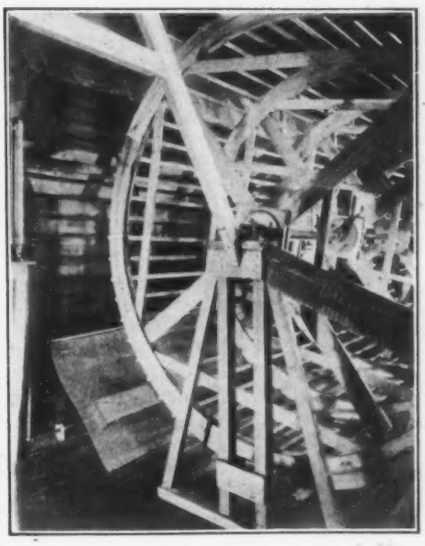
Prisoners to Excavate for Conduit Installations.—Under an agreement with the Lawrence Railway & Light Company, the city of Lawrence, Kan., is to furnish prisoners from the city jail to help make excavations in the sidewalks for the installation of the conduit for the new "white-way" system. The lighting company, which will get a five-year contract on the basis of 4 cents per kilowatt-hour, will meet all expenses above 50 cents a running foot, except the cost of street intersections, which the city will assume in full.

Rifle Range with Electric Target Indicators.—The Marksmen's Society of Spandau, near Berlin, Germany, just before the outbreak of the war had all its rifle ranges fitted with electric remote-target indicators. After a marksman has fired his shot he presses a push-button which actuates a buzzer to call the attention of the operator at the target. The operator points out whether the shot was high or low, or to the right or left, and adjusts his transmitter index to the number of the ring hit by the marksman. While he is shifting this index, the electric buzzers of the transmitter and the receiver are sounded simultaneously, and the receiver index takes up the same position as that of the transmitter, indicating to the marksman the value of his shot.

A Daytime Electric-Lighted Railroad-Crossing Signal.—At Tropico, Cal., the Southern Pacific Railroad has installed at the approach to one of its crossings a "distant" signal, the feature of which is a powerful incandescent lamp mounted in a cylindrical tube, 8 in. in diameter and 2½ ft. long, supported horizontally at the top of a pipe 6 ft. high. The rear end of the tube is closed, and inside, about 18 in. from the open end, is a red-glass lens, behind which is the lamp and its reflector. Wires are carried to this lamp from the regular crossing signal, which is of the "wig-wag" type and which is also electrically operated. Both the "wig-wag" and the tube or "distant" signal are used in the daytime as well as at night. As the inside of the tube is painted black and as the lamp is set far back in the tube, the distant signal can be seen almost as plainly in daylight as at night.

The Predicament of Mr. Taylor.—Because he is the president of the Jersey Electric Company of Clinton, N. J., the only electric company that can possibly supply the State Reformatory for Women at Clinton, Knox Taylor of High Bridge has been obliged to resign as a member of the board of managers of the institution. Governor Fielder accepted the resignation with regret. Mr. Taylor was the vice-president of the board and, in the opinion of the Governor, was one of its most valuable members. It is a violation of the crimes act for any member of a board to supply any commodity to an institution, and as the reformatory could not purchase electric power except from Mr. Taylor's company, there was nothing for him to do but resign. Mr. Taylor's home is not far from the reformatory, and he gave valuable services by his supervision of the construction work and in other ways.

Motion-Picture Films Dried Electrically.—At the studios of the Standard Film Company, near Yonkers, N. Y., four electrically heated machines are employed for drying films in damp weather. Each machine is equipped with a 3-kw. heating unit past which the film to be dried is caused to move by being rotated on a large drum. Two such drums are installed on one shaft and a 1-hp. motor is used for driving each pair of drums. The New York Edison Company, which supplies the electrical energy, estimates the yearly energy consumption of these four driers to be about 2000 kw.-hr.



DRYING MOTION-PICTURE FILMS WITH ELECTRIC HEAT

Electric Lights Mobilize Texas Crickets.—During August of each year a cricket plague, it is said, comes down upon that section of Texas within a 100-mile radius of Taylor. In Austin there are a number of steel towers about 100 ft. high, each carrying six large nitrogen-filled tungsten lamps. These lamps can be seen for miles around, and during the plague crickets attracted by the light swarm into the city. The trouble has at times become so serious that all street lamps are extinguished except on very dark nights.

Idaho, "the Electric State."—"Electricity, air, water, sunshine and soil are the five cardinal points in the progress of human life," is the epigrammatic comment attributed to Gov. Moses Alexander of Idaho by a recent interviewer. "Although electric energy is being used by great numbers of farmers in Idaho to-day, we need more of it," he continued. "I know of farmers living 40 miles from the railroad who are using as many electrically driven machines as the farmers whose land lies close to the big towns. There are thousands of struggling farmers who are unable to hire help and who are only too ready to adopt electric service and appliances in working their land. I see the time not far away when our farmers will obtain electric energy as cheaply as they obtain water to-day. In Rupert, Burley, Hayburn, Twin Falls and other sagebrush towns of Idaho more than 50 per cent of all the houses are not only wired for lighting but are actually heated by electricity. And these towns are not more than eight years old. This is an illustration of why Idaho is an electric state."

A Small Boy, a Kite, and a Transmission Line.—On a three-phase, 11,000-volt transmission line on Long Island considerable trouble was experienced from the frequent opening of the oil switches at both ends, apparently caused by momentary short-circuits. This trouble always occurred on windy days, which led to the belief on the part of the maintenance crew that something was swinging into the line. A careful inspection of the whole line failed to disclose any tree branches or other objects that could possibly touch the conductors, and it was purely by accident that the real cause of disturbance was later discovered. It consisted of two small boys and a kite with a picture-wire tail. Two of the linemen noticed the boys in a vacant lot through which the line passed and stopped a minute to watch them get their kite up. Once in the air the kite was maneuvered toward the line by the boys and when directly over the wires the boys cut the string, causing the kite to drag its wire tail over the conductors, short-circuiting two. The fireworks which resulted were greeted with howls of delight from the boys, but after persuasion of a most practical character from the linemen the young Franklins decided to seek safer fields for flying their kite.

Associations and Societies

Mayor Blankenburg Addresses Philadelphia Jovians.—Mayor Rudolph Blankenburg addressed the Philadelphia Jovian League at the luncheon held at the Hotel Adelphia Sept. 30. The league has planned a rejuvenation to be held Oct. 8. Washington Devereux, Bullitt Building, Philadelphia, is tribune.

New York A. I. E. E. Meeting.—The 312th meeting of the American Institute of Electrical Engineers will be held in the auditorium of the Engineering Societies Building, New York, Oct. 8. The general subject of the meeting will be "Rates," and a paper will be presented by Paul M. Lincoln on "Rates and Rate-Making."

Change of Date in Mississippi Convention.—The Mississippi Electric Association, which is affiliated with the National Electric Light Association, has changed the date of its annual meeting at Hattiesburg from Nov. 10 and 11 to Nov. 12 and 13. H. F. Wheeler, Hattiesburg, Miss., is secretary and treasurer of the association.

Telephone Society of New York.—The 1915-1916 season of the Telephone Society of New York will be opened with a meeting at the Engineering Societies Building, New York City, on Oct. 5. Theodore N. Vail, president of the American Telephone & Telegraph Company, will make the address, the subject of which has not been announced.

Dallas Electric Club Visits Power Plant.—Another educational trip was made by the members of the Dallas (Tex.) Electric Club on Sept. 24, when they made a tour of inspection of the works of the Dallas Electric Light & Power Company. On Sept. 14 M. H. Hallenbeck of the Westinghouse Manufacturing & Electric Company gave an interesting talk on "Meters."

Rochester Section, A. I. E. E., Meeting.—The Rochester (N. Y.) Section of the American Institute of Electrical Engineers held a meeting on Sept. 17 at the headquarters of the Rochester Engineering Society in the Sibley Building. "The Erection of Cables on Transmission Lines" was discussed by J. P. King, erecting engineer on the Big Creek and California-Nevada systems.

Pittsburgh Section, A. I. E. E., Opens Season.—The first meeting of the 1915-1916 season of the Pittsburgh Section of the American Institute of Electrical Engineers was held on Sept. 21 at the Seventh Avenue Hotel. The program included a dinner, after which a paper on "Outdoor Substations" was presented by B. W. Kerr, manager of the Railway & Industrial Engineering Company.

Chicago Electric Club-Jovian League Hears Talk on Radiant Energy.—At the Sept. 30 meeting of the Chicago Electric Club-Jovian League Dr. Robert A. Millikan, professor of physics, University of Chicago, gave an interesting illustrated address on "The Nature of Radiant Energy." At the Oct. 14 meeting a symposium will be held by important men in the industry who will be in Chicago attending the Jovian convention.

Eastern New York Section, N. E. L. A.—At a meeting held in the Roricks Glen Theater, Elmira, N. Y., by the Eastern New York Section of the National Electric Light Association, C. H. Hill, designing engineer of the electric control equipment of the Panama Canal, gave an address illustrated with motion pictures on "The Panama Canal Locks." D. P. Burleigh, meter specialist with the General Electric Company, addressed the meeting on "Watt-hour Meters."

October Conventions.—Annual conventions will be held in October by the following electrical societies: American Electric Railway Association, San Francisco, Cal., Oct. 4 to 8; Jovian Order, Hotel Sherman, Chicago, Ill., Oct. 13 to 15; Electric Vehicle Association of America, Cleveland, Ohio, Oct. 18 and 19; Kansas Gas, Water, Electric Light & Street Railway Association, Topeka, Kan., Oct. 21; Association of Railway Electrical Engineers, Hotel LaSalle, Chicago, Ill., Oct. 18 to 22.

Annual Congress National Safety Council.—The fourth annual congress of the National Safety Council will be held at Philadelphia, Oct. 19, 20 and 21. Accident prevention in all its phases will be discussed and the particular problems of the various industries will be presented in separate meetings. Dr. E. B. Rosa of the Bureau of Standards will be chairman of the public utilities sectional meetings, to be held Oct. 20. The program for this session is as follows: "Linemen and Their Operations," by C. B. Scott, manager Bureau of Safety, Middle West Utilities Company, Chicago, Ill.; "Danger of Low-Tension Shocks," by H. S. Warren, American Telephone & Telegraph Company, New York; "Hazards of High-Tension Lines," by Bryce E. Morrow, chief engineer Utilities Mutual Insurance Company, New York; "Hazards of Gas Works," by J. B. Douglas, manager claim department, United Gas Improvement Company, Philadelphia; "Hazards of Street Work," by Edward C. Spring, assistant to the president Lehigh Valley Transit Company, Allentown, Pa., and "Education of Street-Car Platform Men," by Rex D. Billings, general claim agent Reading (Pa.) Transit & Light Company.

Public Service Commission News

Illinois Commission

An indication of the manner in which the Illinois State Public Utilities Commission will compute depreciation of property in all cases where that question comes up was given in a decision just handed down in the case of the complaint of the city of Belleville, Ill., against the St. Clair County Gas & Electric Company. The commission adopted the "straight-line" method of determining depreciation instead of the "sinking-fund" method of the company. While the complaint was against both the gas and the electric company, the ruling is only in regard to gas, and the price for gas to Belleville is cut from $1.15 net to $1 net per 1000 cu. ft. The commission fixes the value of the Belleville property at $265,000, considerably less than the value fixed by the company. It allows a return of 7¼ per cent on investment and 3 per cent for depreciation.

The text of the commission's ruling on the method of determining depreciation of property is as follows:

"The two principal methods of determining depreciation have been introduced in the hearings of this case. The respondent has submitted a valuation in which the present worth of the property is deduced by the sinking-fund method of reckoning depreciation, whereas the commission's engineering staff has submitted a valuation in which present worth is deduced by a simple straight-line method. Neither method needs elaborate explanation and amplification at this time. It is sufficient to note that the sinking-fund method provides for a slower depreciation in value during the early years of the life of the equipment than is provided by the straight-line method. The sum to be set aside annually to cover the sinking-fund depreciation, however, is a relatively smaller operating charge than the sum required by the straight-line method. Thus in computing a fair rate schedule the interest on a higher capitalization which may be found by using sinking-fund methods is offset to a certain extent by the lower annual depreciation charges on operating accounts. It is to be noted, moreover, that the straight-line method seems to be the best average of all the theoretical methods of computing depreciation."

Philippine Islands Commission

In considering the valuation of the Manila Electric Railway & Light Company the Philippine Islands Board of Public Utility Commissioners pointed out that "going cost" should be understood to mean the cost of placing the operation of the property on a paying basis, made up of the difference between the gross earnings derived from the operation of the property and the cost of operating it. The cost is to include operating expenses, taxes, depreciation, safeguarding the investment, return on investment, together with interest on deficits from operation, figured cumulatively. Bond discount is in the nature of an advance payment of interest and should not be treated as capital investment. It should be made up out of income by the creation of a sinking fund or reserve sufficient to cover the item by the time the bonds mature. The cost of properties purchased for the purpose of scrapping them and replacing them with other properties should not be treated as a part of the fixed investment, but should be met out of income just as any other item of depreciation. It is in the nature of a charge for maintenance, and is not an item on which the company is entitled to earn a return.

Corporate and Financial

Allis-Chalmers Company's Statement Shows Better Business.—The quarterly statement of the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., shows the great improvement which has been accomplished in the company's manufacturing operations during the last year. The sales billed, expenses less other income, and the net profits of the company by months, as far as reported, have been as follows:

1914	Sales Billed	Expenses	Profit
April	$990,834	$972,279	$18,555
May	939,950	939,006	944
June	820,335	825,078	*4,743
July	871,693	848,682	23,011
August	803,985	803,186	799
September	856,865	861,803	*4,938
October	862,152	864,402	*2,250
November	701,640	731,593	*29,953
December	684,383	699,083	*14,700
1915			
January	535,284	580,000	*44,716
February	652,998	667,164	*14,666
March	928,429	778,962	50,467
April	927,832	889,317	38,515
May	969,017	912,113	56,904
June	919,332	819,934	99,398

*Loss.

For the year ended Dec. 31, 1914, the company reported a loss of about $25,000 on sales of about $10,000,000. In the twelve months ended June 30, 1915, the company made a profit of $158,371 on gross sales billed of $9,600,000. The quarterly business since Jan. 1, 1914, has been as follows:

Quarter ended	Sales Billed	*Expenses	Unfilled Orders
March 30	$3,791,312	$2,803,105	.....
June 30	2,751,119	2,736,363	$3,086,795
Sept. 30	2,532,544	2,513,672	2,638,569
Dec. 31	2,248,175	2,295,078	2,400,663
Year	$10,323,150	$10,349,218	.....
March 30	2,017,712	2,026,627	3,279,630
June 30	2,816,181	2,621,368	7,657,185
Six months	$4,833,893	$4,647,995	.....

*Less other income.

The net profits of the company for the June quarter were at the rate of 5 per cent a year on $15,849,500 preferred stock.

Central Indiana Lighting Company, Columbus, Ind.—The Indiana Public Service Commission has authorized the issuance of $14,000 bonds by the company, to reimburse its treasury for $3,000 expended in the retirement of underlying bonds of the People's Gas, Electric & Heating Company, and $11,000 for extensions and betterments made to the property of the company in the cities of Bloomington and Columbus, Ind.

Duquesne Light Company, Pittsburgh, Pa.—A large amount of an issue of $2,500,000 of 7 per cent cumulative preferred stock of the company having been sold, the remainder is being offered at 104 and accrued dividend to yield 6.73 per cent. The present issue increases the total of this stock outstanding to $4,426,000.

Housatonic Power Company, New Haven, Conn.—The New York, New Haven & Hartford Railroad has decided to reduce the book value of $2,985,978, at which the 30,000 shares of Housatonic Power Company stock are carried, by approximately $1,200,000. This is with a view of bringing the book value more nearly into line with the estimated value. Several interests have made inquiries looking to the possible purchase of the Housatonic Power and Waterbury Gas properties, and negotiations, it is reported, are still in progress.

Lorain County Electric Company, Elyria, Ohio.—The Ohio Public Utilities Commission has authorized the company to purchase the light and power business and plant of the Elyria Milling & Power Company, the Ely Realty Company and the Baltimore & Ohio Railroad Company, to lease the Citizens' Gas & Electric Company, and to purchase other H. L. Doherty & Company interests in Elyria and Lorain. In payment therefor the commission has authorized the company to issue $750,000 of common stock and $750,000 of first mortgage forty-year 5 per cent bonds.

Montana Power Company, Butte, Mont.—The New York Stock Exchange has admitted the listing of $75,500 additional common stock, making the total amount listed to date $27,133,300. The surplus of the company as of July 31, 1915, was $1,060,681. A consolidated income account for the seven months ended July 31, 1915, shows the following earnings:

Gross earnings		$2,221,900
Operating expenses and taxes		662,173
Net earnings		$1,559,728
Dividends on investments		3,063
Interest received from banks and outside sources		33,483
Net income		$1,596,274
Interest paid:		
On bonds	$756,452	
Bond discount	50,465	
On floating debt	20,539	
	$827,456	
Less: Charged to construction	176,668	
		650,788
Surplus income for the seven months		$945,486

Standard Gas & Electric Company, Chicago, Ill.—Although subscriptions to the company's new $3,750,000 twenty-year 6 per cent gold note issue do not close until Oct. 15, a large response has already been had from many stockholders. It is realized that the success of the present financing will restore cash dividends on the preferred stock much sooner than would otherwise be possible.

Tulare (Cal.) County Power Company.—A meeting of the stockholders has been called for Oct. 5, at which time it is expected the company will be dissolved. At the meeting it is planned to make another payment to the stockholders of about $50,000 and to burn the bonds signed by about 285 stockholders in connection with the Wrightsman loan.

United Gas & Electric Company, New Albany, Ind.—The Indiana Public Service Commission has authorized the company to issue $4,000 of bonds, to be sold at not less than 80, for extensions and betterments.

United Light & Railways Company, Grand Rapids, Mich.—A block of $750,000 of 6 per cent gold coupon notes is being offered at par and interest. The proceeds from the sale of these notes will be used to complete payments on properties heretofore acquired and to reimburse the treasury of the company for the cost of improvements to subsidiary properties.

Washington-Oregon Corporation, Vancouver, Wash.—The sale of the company's properties, which was originally set for July 3 but was postponed, will be held on Oct. 16. The properties to be sold include a plant in Hillsboro, Ore., another in southwest Washington, a railway system in Clarke County and an interurban railway between Centralia and Chehalis. It is expected that they will be purchased by the bondholders' reorganization committee.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.—The directors have declared a 1½ per cent quarterly dividend on the common stock, an increase of 0.5 per cent, thereby placing the stock on a 6 per cent basis. It is significant that the dividend increase was warranted solely for normal business during the quarter, for the quarter's earnings included nothing from the rifle business. The following statement regarding war orders has been issued by the directors: "Westinghouse Electric has received contracts for the manufacture of war munitions aggregating approximately $60,000,000, the greater proportion of which is a contract for rifles which is to be executed at factories in New England especially acquired for the purpose." The company made the following announcement regarding conversion of its bonds, issue of 1915: "Bonds presented for conversion up to and including Sept. 29 will be converted on the basis of an allowance of interest on the bonds at the rate of 5 per cent per annum from July 1 to the date of conversion, with a reduction at rate of 6 per cent per annum from July 30 to date of conversion. Bonds presented on Sept. 30 and up to and including Oct. 29 will be converted on basis of an allowance of interest on the bonds at rate of 5 per cent per annum from July 1 to date of conversion, with a further allowance of dividends at the rate of 6 per cent per annum from date of conversion to Oct. 30. Bonds presented for conversion on Oct. 30 and up to the date of action by the board at its meeting in December will be converted on the basis of an allowance for interest on the bonds at rate of 5 per cent per annum from July 1 to date of conversion, with a deduction for dividends from Oct. 30 to date of conversion at rate of 6 per cent per annum."

Manufacturing and Industrial

The Brokaw-Eden Manufacturing Company, manufacturer of electric washers, has moved from Chicago to Alton, Ill., where it has a new factory building.

The Fibre Conduit Company, Orangeburg, N. Y., has changed its New York office from 103 Park Avenue to 101 Park Avenue. The new quarters are three times as large as the old.

The Canadian Carbon Company, Toronto, Canada, manufacturer of dry cells, flashlamps and other electrical specialties, has just appointed W. M. Turnley manager. Mr. Turnley was formerly sales manager for the Northern Electric Company, Montreal.

The Boston Belting Company, 84 Linden Park Street, Boston, Mass., manufacturer of rubber belting and packing, has appointed W. E. Hardy, for the past eleven years connected with the Diamond Rubber Company and the B. F. Goodrich Company, its sales manager.

Robert S. Ingle, Cleveland, Ohio, formerly sales manager for the Tregoning Electric Manufacturing Company, is now connected with the New York Life Insurance Company and is making a specialty of protection for electrical and automobile men. Mr. Ingle's name appears on the company's July and August honor roll as one of the twenty leaders on both the number of policies and the volume of business written.

The Trumbull Electric Manufacturing Company, Plainville, Conn., has appointed Max. L. Spaulding a member of its sales force. He will assist J. S. Jacobson, who is manager of the company's Chicago office at 15 South Desplaines Street. Mr. Spaulding was formerly connected with the Julius Andrae & Sons Company, Milwaukee, and the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

The Aladdin Lamp Corporation, 52 Vanderbilt Avenue, New York, manufacturer of portable lamps, has recently appointed the following as district managers: T. E. Nesom, Hibernia Bank Building, New Orleans, La., who will handle the company's business throughout the State of Louisiana, and A. Manton Chase, 714 Merchants' National Bank Building, Los Angeles, Cal., and T. J. Nielan, 41 Arlington Street, San Francisco, Cal., who will have charge of southern and northern California territory respectively.

Electrical Exports.—Figures compiled by the foreign-trade department of the National City Bank of New York show that there was exported from the port of New York during the week ended Sept. 4, 1915, $208,354 of electrical material, as compared with $36,974 during the week ended Sept. 5, 1914. During the week ended Sept. 11 the value of electrical exports for New York was $197,402, as compared with $140,187 during the corresponding week in 1914. About 55 per cent of the goods of American manufacture exported from the United States go from the port of New York.

Julio Compte y Riqué, commissioner and engineer of the department of electric light of Uruguay, South America, will be in this country for the next six months to meet manufacturers of electrical goods with a view to purchasing supplies for his department. Mr. Riqué is principally interested in 100-hp. to 200-hp. steam engines, 8000-kw. steam turbines, three-phase motors, cables and wire, insulators, lamps and materials for electrical installations. Such orders were formerly placed in Germany, but with this market closed America is turned to. Mr. Riqué can be reached at the Consulate General of Uruguay, 17 Battery Place, New York City.

Edison Lamp-Sales Contest Popular in Louisville.—In Louisville, Ky., a keen interest is being manifested in the lamp-sales contest for boys and girls which has been inaugurated by the Edison Lamp works of the General Electric Company and which was described in the ELECTRICAL WORLD of Sept. 4 and Sept. 18. Besides the numerous prizes being offered by the Edison Lamp Works as an incentive, the Belknap Hardware & Manufacturing Company, agent for the Edison Lamp Works, is offering a "Belknap Motorbike" bicycle to the boy who makes the largest number of sales among the boys and $20 in gold to the girl credited with the greatest number of sales among the girls.

The Goulds Manufacturing Company, Seneca Falls, N. Y., has just opened an office at 111 North Third Street, Philadelphia, Pa. The company has purchased the business of H. E. Trotman, who up to the present time has been distributer for Goulds pumps in the Philadelphia territory, and has leased from him the storeroom and warehouse at the above address. E. S. Jenison, formerly with the Canadian Fairbanks-Morse Company, Ltd., Montreal, has been appointed manager of the office, and F. G. Kramer, formerly in the employ of H. E. Trotman, will be assistant manager. J. B. Trotman will continue his connection with the Goulds Manufacturing Company. The Philadelphia office is the third that has been opened within the past ten months by the Goulds company, the other offices having been opened at Pittsburgh on Aug. 1, 1915, and at Atlanta on Dec. 1, 1914.

Resuscitation Apparatus for United States Bureau of Mines.—The "lungmotor" made by the Life Saving Devices Company, 180 North Market Street, Chicago, Ill., has been approved by the United States Bureau of Mines. The bureau has purchased fifteen of these devices, which will be installed in its mine-rescue cars and stations. There are mine-rescue stations at Pittsburgh, Pa.; Scranton, Pa.; Billings, Mont.; Denver, Col.; Birmingham, Ala.; Evansville, Ind., and Urbana, Ill. The instrument is also installed on mine-rescue motor trucks and in "The Mine" at the Panama-Pacific Exposition at San Francisco, Cal. The "lungmotor" is being used in various other departments of the United States. It is also employed on the Greek battleship Kilkis, in The Hague (Holland) General Hospital, and in a large number of city and state departments, hospitals, municipal plants, park and bathing-beach resorts, coal, copper and iron mines, schools, hotels, undertaking establishments, etc.

Westinghouse Company Establishes Saving Fund for Employees.—In order to encourage a spirit of thrift among its employees the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has just established a savings fund which offers facilities to its employees for handling their savings accounts. This fund is open to any employee of the company wherever he may be stationed, and he may become a depositor at any time and discontinue at any time. The amount of the deposit cannot be less than 10 cents and may be any multiple thereof, and the deposits must be made from each regular payment of wages. The deposit, however, is limited to one account, the amount of which in any one year cannot exceed $500. The idea of this plan is to encourage the employee to save his earnings, and when he has been successful up to a certain point allow him to handle his own finances. Interest is paid on the deposits at the rate of 4.5 per cent and is credited semi-annually. An interesting feature of the fund is that the Westinghouse Electric & Manufacturing Company acts as a trustee and guarantees the deposits and interest. The rules provide that an amount of $100 or less may be withdrawn without notice, but an interval of two weeks must elapse before subsequent withdrawal can be made, and for withdrawals of more than $100 notice of one week must be given. An auditing committee not to exceed seven persons is to be elected by the depositors from their own number, and this committee shall have an opportunity to examine the condition of accounts at each semi-annual-interest period, and its findings shall be published.

The Increasing Use of Motor-Driven Blowers for Mechanical Orchestras.—The Kinetic Engineering Company, Baltimore Avenue and Sixtieth Street, Philadelphia, Pa., manufacturer of electrically operated blowers for church organs and mechanical orchestras, is noting a large demand for its combined blowing and suction machines for use in amusement places, particularly in motion-picture theaters. Especially is this the case in New York and vicinity, where the mechanical playing instruments or orchestras are frequently being employed as substitutes for the orthodox orchestra, with economy both in money and in space. The Kinetic company's blowers are used exclusively by the following concerns with their mechanical players: the American Photo Player Company, the Seeburg Piano Company, the Rudolph Wurlitzer Company, and the Symphony Player Company. The blower usually consists of a single fan for blowing purposes and five fans for creating a suction, all

of the fans being mounted on the same shaft, which is connected directly to the motor shaft. Ball bearings are employed, and in operation the entire apparatus is practically noiseless. One of the theaters which have recently adopted the mechanical orchestra is the famous New York Hippodrome. A 7.5-hp. Kinetic blower will be utilized to operate the apparatus. Following are other prominent theaters in New York where the Kinetic blower is employed: The Cort, a 3-hp. machine; the Criterion, a 3-hp. machine; the Vitagraph, a 15-hp. machine; the Claremont, a 3-hp. machine; the Broadway, a 5-hp. machine; Loew's Orpheum, a 7.5-hp. machine, and the Academy of Music, one machine (3-hp.) on the stage and another (3-hp.) in the upper gallery. In the smaller motion-picture theaters 1-hp. and 2-hp. outfits are generally employed. The Tel-Electric Piano Company and M. Welte & Son are developing musical apparatus of the mechanical-orchestra type for use in residences. A wide field presents itself for these instruments, which are operated by Kinetic blowers. For use with church organs a blower without the suction fans is employed. Several fans are mounted on one shaft, which is directly connected to the shaft of the motor. The outfit is mounted on ball bearings and is very quiet in operation. A large number of churches throughout the country are equipped with blowers made by the Kinetic Engineering Company, there being over 400 churches in New York State alone using the machines.

NEW YORK METAL MARKET PRICES

	Sept. 21 Selling Prices Bid	Sept. 21 Selling Prices Asked	Sept. 28 Selling Prices Bid	Sept. 28 Selling Prices Asked
	£ s d		£ s d	
London, standard spot*	70 7 6		71 0 0	
Prime Lake	17.62½ to 17.87½†		17.90 to 18.00	
Electrolytic	17.75 to 18.00†		17.90 to 18.00	
Casting	16.62½ to 16.87½†		17.00 to 17.25	
Copper wire base	19.25 to 19.50†		19.25 to 19.50†	
Lead	4.50		4.50	
Sheet zinc, f.o.b. smelter	16.00†		16.00†	
Spelter, spot	13.62½ to 13.75†		14.37½ to 14.62½†	
Tin, Straits	33.00		33.12½	
Aluminum, 98 to 99 per cent	47.00†		48.50†	

OLD METALS

Heavy copper and wire	15.75	15.00†
Brass, heavy	11.00	9.75†
Brass, light	9.00	8.00†
Lead, heavy	4.20	3.75†
Zinc, scrap	10.50	9.50†

*COPPER EXPORTS

Total tons to Sept. 28	12,071

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Campbell Electric Light & Power Company of Campbell, Mo., has been chartered with a capital stock of $30,000 by Benjamin F. Eicholz, R. C. Jones and W. E. Glenn.

The Cumberland County Electric Company, Bridgeton, N. J., has filed articles of incorporation with a capital stock of $100,000 for the purpose of generating and distributing electricity.

The Florida Ice & Power Company, Lake Wales, Fla., has been chartered with a capital stock of $100,000. The officers are: E. C. Stuart, president; G. V. Tilman, vice-president, and E. D. Edis, secretary and treasurer.

The Prince George Electric Light & Power Company, Hopewell, Va., has been incorporated with a capital stock of $100,000. The officers are: H. D. Eichelberger, Chester, president; M. H. Mulligan, Richmond, secretary, and W. H. Hoyt, Hopewell, general manager.

The Middle Georgia Power Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $700,000. The incorporators are Herbert E. Latter and William J. Maloney, both of Wilmington, Del., and Clement M. Egner of Elkton, Md.

New Industrial Companies

The Reynolds-Chellman Electric Company of Boston, Mass., has been incorporated with a capital stock of $15,000 by Chester H. Reynolds, J. Edward Chellman and George R. Colburn.

The Equitable Contracting Company, New York, N. Y., has been incorporated with a capital stock of $5,000 to do general engineering and electrical construction work. The incorporators are Samuel M. Richardson, Frank L. Mueller and William J. Canary, 443 Sumner Avenue, Brooklyn, N. Y.

The Electric Changeable Sign & Illuminating Company, New York, N. Y., has been chartered with a capital stock of $50,000 by M. Freixas, 136 Front Street, New York, N. Y.; S. Weinstein, 1149 Stebbins Avenue, the Bronx, and P. Weinstein, Belmar, N. J. The company proposes to do general electrical contracting, sign and illuminating work, etc.

Trade Publications

Single-Phase Motors.—The Century Electric Company, St. Louis, Mo., has prepared an illustrated folder which shows various applications of its small single-phase motors.

Stationary Vacuum-Cleaning Machines.—The George S. Knox Company, 513 Pennwood Avenue, Wilkinsburg, Pa., has published an illustrated leaflet which describes its stationary vacuum-cleaning apparatus.

Large-Sized Power-Transmission Chains.—The Morse Chain Company, Ithaca, N. Y., is sending out its illustrated Publication No. 14, which contains information on its chains for large power-transmission systems.

Show-Window Reflectors.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, Ill., has just brought out an attractive illustrated catalog which contains information on its fixtures for show-window, store and showcase lighting.

Motors and Other Apparatus.—"The Plant and the Product" is the title of an attractively illustrated booklet which contains a short outlined history of the Wagner Electric Manufacturing Company, St. Louis, Mo., and briefly describes and illustrates the various products of the company.

Electric Measuring Instruments.—The Weston Electrical Instrument Company, Newark, N. J., has just issued Bulletin No. 2002, on its recently developed Model 310 and Model 329 wattmeters; Bulletin No. 2003, on its Model 370 ammeters, and Bulletin No. 2004, on its Model 341 voltmeters.

Lighting of Moving-Picture Studios and Glass Factories.—"The Artificial Lighting of Moving-Picture Studios" is the title of a reprint from the *Illuminating Engineer*, and "The Illumination of Glass Factories" is the title of a reprint from the *Electrical Review and Western Electrician*, which have been issued by the Cooper Hewitt Electric Company, Hoboken, N. J.

Incandescent Lamps.—The National Lamp Works of the General Electric Company, Cleveland, Ohio, have just issued Bulletin No. 13E, on their nitrogen-filled and vacuum tungsten lamps with ratings from 10 watts to 1000 watts; Bulletin No. 25, on street series alternating-current incandescent-lamp circuits, and a supplement to Bulletin No. 20, on industrial lighting. The company is also sending out a reprint of an article entitled "Life-Testing Equipment for Tungsten Lamps," which appeared in the ELECTRICAL WORLD of July 3.

Exporting.—A series of pamphlets have been prepared by the West Side Y. M. C. A., 318 West Fifty-seventh Street, New York, which deal with practically every phase of exporting. They cover such subjects as trade methods, geographic problems, packing, forwarding, competition, etc., and are written by such men as Welding Ring, president American Exporters and Importers' Association; William L. Peck, Emerson E. Parvin, secretary International Mercantile Marine; William S. Kies, foreign department National City Bank, O. P. Austin, James I. McCleary, secretary Iron and Steel Institute, and others.

Construction News

New England

MOUNT VERNON, MAINE.—The Public Utilities Commission has authorized the Mount Vernon Lt. & Pwr. Co. to generate and distribute electricity in the towns of Mount Vernon, Vienna and Rome.

MANCHESTER, N. H.—The city officials have signed a contract with the Manchester Trac., Lt. & Pwr. Co. for lighting the streets of the city for a period of five years. The new contract provides for 580 arc lamps and 466 tungsten lamps. The lighting of Elm Street has not yet been decided upon. It is expected that ornamental lamp standards will be used.

PORTSMOUTH, N. H.—Steps have been taken by several of the business men on Vaughan Street for the installation of an ornamental lighting system on that thoroughfare.

Middle Atlantic

ALBANY, N. Y.—The Public Service Commission, Second District, has approved the franchises of the Municipal Gas Co., Albany, for furnishing electricity for lamps, heaters and motors in Bethlehem, New Scotland, Guilderland, Altamount and Voorheesville. The commission has also approved the sale of the property of the Altamount Illg. Co. The plant, it is understood, will be abandoned.

BROOKLYN, N. Y.—The Kings County Ltg. Co., Brooklyn, has applied to the Public Service Commission for permission to issue $675,000 in bonds.

BUFFALO, N. Y.—Plans have been filed by the Delaware, Lackawanna & Western R. R. Co. for the erection of a substation at 60 Ohio Street, to cost about $8,000.

CAPE VINCENT, N. Y.—The Northern New York Utilities, Inc., Watertown, has applied to the Public Service Commission, Second District, for authority to acquire the municipal electric-light plant in Cape Vincent, construct a transmission line and exercise a franchise granted by the village, and also to issue $38,192 in capital stock and mortgage bonds. The village of Cape Vincent has filed a petition asking for the consent of the transfer of the plant.

COBLESKILL, N. Y.—The Mohawk Hydro-Electric Co., Ephratah, has been awarded a contract to furnish electricity for lighting this village.

FORT H. G. WRIGHT, N. Y.—Bids will be received until Oct. 12 for furnishing and installing a new underground street-lighting system, including 11 lamps at Fort Terry. Further information may be obtained upon application to constructing quartermaster.

FREDONIA, N. Y.—The Niagara & Erie Pwr. Co. of Fredonia has applied to the Public Service Commission for permission to erect transmission lines and operate franchises in the towns of Sheridan, Pomfret, Portland and Brant and the village of Farnham.

GENEVA, N. Y.—The Public Service Commission, Second District, has approved of issues of securities by the Empire Gas & El. Co., the Central New York Gas & El. Co. and the Empire Coke Co., all of Geneva, which will result in an expenditure of $161,200 for improvements in the electric departments of the companies as follows: In Auburn, $20,204; Geneva, $31,705; Waterloo, $21,475; Seneca Falls, $7,335; Phelps, $2,011; Palmyra, $2,504; Newark, $20,108; Lyons, $4,008, and Clyde, $2,504. In addition, $1,324 will be spent on a telephone line and $8,000 on a transmission line between Seneca Falls and Waterloo. Improvements will also be made to the gas plants of the companies.

LANCASTER, N. Y.—The Public Service Commission has authorized the Depew & Lancaster Lt., Pwr. & Conduit Co., Lancaster, to issue $49,000 in bonds, at 80, the proceeds to be used for completion of distributing system in Seneca and for other improvements.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until Oct. 11 for installing electric equipment in new Public School 8, at intersection of Linwood Avenue and School Street, Great Kills, borough of Richmond. Blank forms, plans and specifications may be obtained or seen at the above office and also at branch office, Borough Hall, New Brighton.

NEW YORK, N. Y.—The Public Service Commission, Second District, has granted the Long Island Ltg. Co., New York, permission to issue $135,000 in bonds and $66,000 in capital stock to provide funds for improvements and additions to its plants and distribution systems as follows: For improvements to the Northport station, $27,456; high-tension transmission line, $12,450; district improvements in Northport, $23,480; in Amityville, $20,030; in Sayville, $18,774; in Islip, $22,700; in Brentwood, $11,520; in Central Islip, $6,500; in Babylon, $20,502, and in Huntington, $3,980; the remainder to be expended for the purchase of right-of-way, miscellaneous construction expenses, etc.

ROCHESTER, N. Y.—Plans are being considered by the City Council for extensions to the street-lighting system on a number of streets in the city.

TROY, N. Y.—The contract for the electrical work in the new dining hall and dormitories being erected at the Rensselaer Polytechnic Institute at Troy has been awarded to the Barnes & Payton Co., Troy, at about $4,000.

YONKERS, N. Y.—The Board of Aldermen has passed an ordinance providing for the installation of 237 new ornamental street lamps.

BENTON, PA.—Negotiations have been closed whereby S. B. Seeley, William J. Hartman and M. S. Bredbenner of Berwick, who are now erecting the Harbred silk mill in Benton, will purchase the property of the Benton El. Co. The new owners will take over the plant Oct. 1.

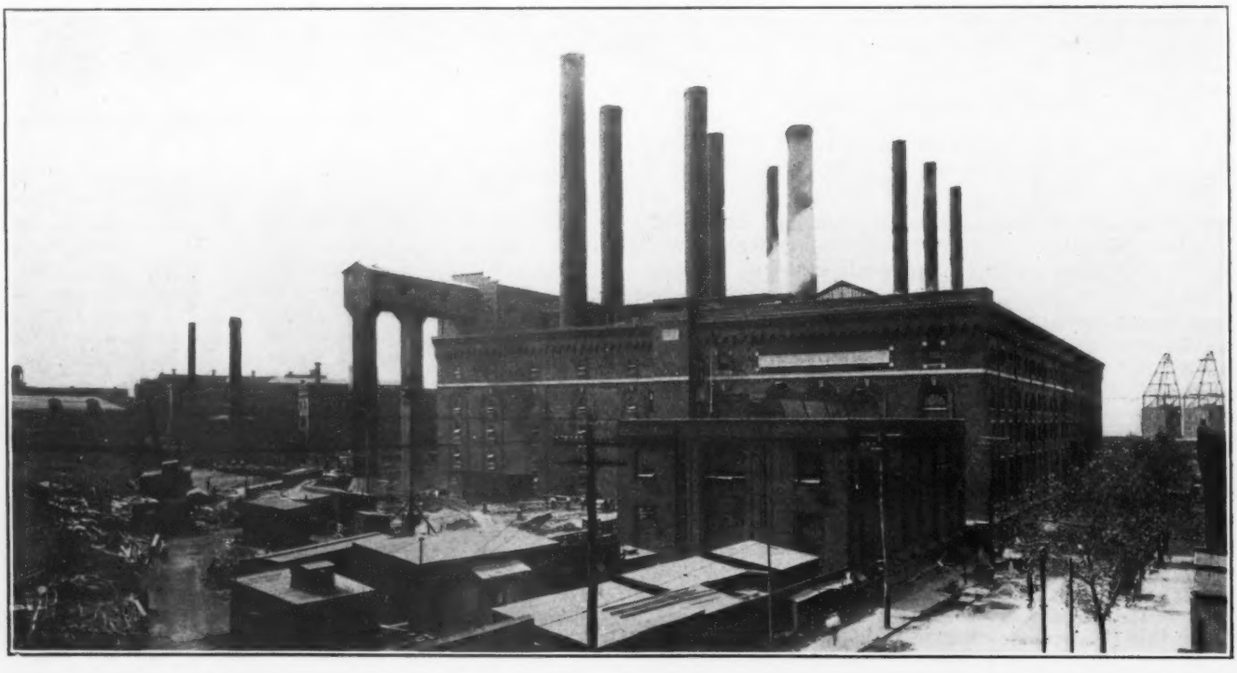
COATESVILLE, PA.—Bids will be received by the Borough Council until Oct. 7 for construction of a high-service water-pumping system, including a 250,000-gal. steel tank, a 750,000-gal. electrically driven centrifugal pump, and furnishing and laying 15,540 ft. of cast-iron pipe. Plans and specifications may be seen at the office of the borough clerk, and copies may be secured at the office of Alexander Potter, 50 Church Street, New York, N. Y., upon deposit of $5.

MILTON, PA.—A special election will soon be called to vote on the proposal to establish a municipal eelctric-lighting plant in Milton.

BRIDGETON, N. J.—The City Commission has awarded the contract for street lighting to the Bridgeton El. Co. for a period of five years. Under the terms of the new contract the company agrees to in-

New Christian Street Station ("A—2"), Philadelphia, Now Nearing Completion

The new generating station of the Philadelphia Electric Company, which is now nearly completed, will contain the largest steam turbine in the world. This turbine has a rating of 35,000 kw. and weighs 600 tons. It drives a 13,200-volt, sixty-cycle, three-phase generator at 1200 r.p.m. The new station also contains a 30,000-kw., 13,200-volt, three-phase, twenty-five-cycle turbine set. This machine will operate at 1500 r.p.m. The exciters for these machines will be mounted on the end of the shaft of each unit. Separate duplicate sets of unsectionalized high-tension busbars are arranged for each frequency, and the control of three of the turbo-generators of the adjoining plant, as well as the frequency-changer sets in the nearby substation, will be centralized in the new station. This will make possible the control of 69,000 kw. in twenty-five-cycle apparatus and 50,000 kw. in sixty-cycle machines, or a total of 119,000 kw. from this station. With the exception of these electrical interconnections and common condensing-water tunnels, there will be no physical connections between the new station and the adjoining old one. Twenty Babcock & Wilcox boilers, each rated nominally at 1000 hp. and each capable of evaporating 60,000 lb. of water per hour, will compose the boiler equipment of the new station, which will rank among the most important in the United States.



stall an entire new street-lighting system and make extensions in different districts.

CAPE MAY, N. J.—At an election held Sept. 14 the proposal to issue bonds for the construction of a municipal electric-light plant was carried.

EAST ORANGE, N. J.—The City Council is considering improvements to the street-lighting system on Central Avenue.

JAMESBURG, N. J.—Bids will be received by the New Jersey State Home for Boys, Jamesburg, until Oct. 5 for furnishing electrical supplies, steamfitting and plumbing supplies, food, provisions, groceries, etc., from Nov. 1, 1915, to March 31, 1916. Applications for schedules and specifications should be addressed to the superintendent, State Home for Boys, Jamesburg. John C. Kalleen is superintendent.

CUMBERLAND, MD.—Plans are being considered by Joseph S. Schriver, water and light commissioner, to reconstruct the fire-alarm system and install additional call boxes.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 12 for furnishing at the various navy yards and naval stations supplies as follows: F.o.b. works, Schedule 8806—144,900 lb. rotating copper bands. Brooklyn, N. Y., Schedule 8816—2500 ft. leaded and armored conductor; Schedule 8811—furnishing and installing mechanical telegraph transmitters; Schedule 8823—1200 Leyden jars; Schedule 8820—miscellaneous rubber-covered wire. Norfolk, Va., Schedule 8805—one storage-battery truck. Bids will also be received until Oct. 19 for furnishing two motor-driven fans at Mare Island, Cal., as per Schedule 8813. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 18,293—An American consul in Spain reports that a concern in his district desires to communicate with American manufacturers of copper wire, tubes, bars and sheet copper. Prices and catalogs are requested at once. Correspondence should be in Spanish or French. No. 18,363—A report from an American consular officer in Spain states that a firm is in the market for metal parts for electric-light bulbs manufactured by American firms. Correspondence should be in Spanish or French. No. 18,375—A report from a consular officer in India states that a firm desires to be placed in communication with American manufacturers of electric ceiling fans. It is stated that there is a very large market for this type of fan. It would like exclusive representation on a commission basis, but if necessary will buy outright. No. 18,398—A consular officer in the Netherlands reports that a firm in that country wishes to establish relations with American manufacturers of electrical supplies. Further information may be obtained upon application at the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and its branches.

North Central

JACKSON, MICH.—A petition, signed by business and professional men, has been presented to the City Council asking that ornamental lamps be erected on the cross streets in the business district.

MONROE, MICH.—Mills, Rhines, Bellman & Nordoff, architects, Ohio Building, Toledo, it is reported, are asking bids for the construction of a factory, 92 ft. by 224 ft., one story, and power house, 50 ft. by 55 ft., for the Weis Fibre & Container Corpn. in Monroe.

THREE RIVERS, MICH.—Bids will be received by the city of Three Rivers until Oct. 21 for construction of electric-light plant and water-works system as follows: Furnishing and installing two vertical-type waterwheels and generators, including exciters, switchboard, street-lighting regulators, transformers, one motor-driven centrifugal fire pump, reset two steam pumps, boiler, heater, feed-water pump and stack, all piping and electric wiring for connecting the above, and a complete street-lighting distributing system and ornamental standards; also one elevated steel tank (150,000 gal. capacity), with necessary piping valves. Plans and specifications may be obtained from Eugene A. Schall, city clerk, or from George Champs and F. H. Froelich, engineers, National Bank Building, Toledo, Ohio.

WYANDOTTE, MICH.—The proposal to issue $30,000 in bonds for improvements to the municipal electric-light plant and water-works system was defeated at the election held Sept. 7.

LIMA, OHIO.—The Reed Brothers Electrical Co., Lima, it is reported, has been engaged to prepare plans and estimates of cost of installing an ornamental street-lighting in the business district and for a municipal electric plant to maintain same.

LORAIN, OHIO.—A petition has been filed with the City Council asking that an election be held to submit to the voters the proposal to issue $350,000 in bonds to establish a municipal electric-lighting plant.

MARIETTA, OHIO.—The City Council has decided to submit to the voters the proposal to issue $45,000 in bonds to install a new municipal electric plant to supply electricity for both street and commercial lighting.

MARTINS FERRY, OHIO.—Preparations are being made to extend the service of the municipal electric-light plant to the Rothermund addition.

MIDDLETOWN, OHIO.—The Middletown Gas & El. Co. is contemplating placing its wires underground in the business section of the city.

LOUISVILLE, KY.—Work has begun by the Louisville & Nashville R. R. Co. on the extension of the A B C block electric signal system from Lafollette to Etowah, Tenn. The cost is estimated at $178,000.

NEWPORT, KY.—The City Commissioners have passed an ordinance requiring the South Covington & Cincinnati Ry. Co. to place all its high-tension wires underground.

BATTLE GROUND, IND.—The Battle Ground Lt. & Pwr. Co., recently organized, has, it is reported, made arrangements to secure electricity from the Fort Wayne & Northern Indiana Trac. Co. to operate the local system. Transformers will be installed at the Buck Creek station of the traction company and from there transmitted to Battle Ground.

EVANSVILLE, IND.—The power house of the Evansville Pub. Ser. Co. was recently damaged by fire, causing a loss of from $75,000 to $100,000.

GOSHEN, IND.—Within the next two weeks the Hawks El. Co., Goshen, expects to purchase boilers, engines, condensers, exciter and switchboard.

GRANDVIEW, IND.—The Rockport Wtr. Wks. Co., Rockport, has applied to the town of Grandview for a franchise to supply electricity here.

INDIANAPOLIS, IND.—The Board of Park Commissioners has authorized the Merchants' Ht. & Lt. Co. to install new ornamental lamps on the new Fall Creek Boulevard, from Thirtieth Street to Thirty-eighth Street. About 85 lamps will be required.

NEWCASTLE, IND.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 27 for construction complete, including mechanical equipment and approaches, of the United States post office at Newcastle. Specifications may be obtained at the above office or from the custodian of site at Newcastle.

CHICAGO, ILL.—The Lincoln Park Commissioners are contemplating the installation of two 300-kw. turbo-generators to be driven by steam from the steam-heating system. Claude H. Shepherd is electrical engineer.

CLINTON, ILL.—Within the next six months the Clinton Gas & El. Co. expects to purchase some electrical appliances, including heating and cooking apparatus, vacuum cleaners, etc., and wiring supplies. Charles A. Cline is superintendent.

GALESBURG, ILL.—The Board of County Supervisors has authorized the jail committee to take steps to equip the county heating plant with machinery to enable it to supply electricity to light the court house.

MOUNT CARMEL, ILL.—The Mount Carmel Public Utility & Service Co. is contemplating extending its service to Allendale and St. Francisville. The company also proposes to supply electricity to residents along the line if the proposition goes through.

STERLING, ILL.—The City Council is contemplating extending the ornamental street-lighting system in Sterling.

CORLISS, WIS.—The Village Council has granted the Milwaukee Lt., Ht. & Pwr. Co., Milwaukee, a franchise to supply electricity in Corliss, and a contract for street-lighting, which provides for thirty street lamps. The company will extend its transmission line from Racine on the Durant Road. Electrical service will also be furnished to residents along the route of the line.

MAIDEN ROCK, WIS.—A franchise has been granted to L. Mathys to install and operate an electric-lighting system in Maiden Rock.

OAK CENTER, WIS.—The installation of an electric-lighting system in Oak Center is reported to be under consideration.

MINNEAPOLIS, MINN.—Cluster lamps, it is reported, will be extended on Hennepin Avenue to Harmon Place.

VIRGINIA, MINN.—The budget for 1916 provides $15,000 for the ornamental lighting system.

CLERMONT, IOWA.—Plans are being considered by C. Miller & Sons, owners of the local electric-light plant, to double the output of their plant. The work will include the installation of a turbine waterwheel and a 300-kw. generator, directly connected, addition to power house, new flume and tailrace. The cost is estimated at $20,000.

CLINTON, IOWA.—The local electric-light plant is reported to have been destroyed by fire, causing a loss of about $4,000.

MONDAMIN, IOWA.—The erection of a transmission line from Mondamin to Missouri Valley to supply electricity in Modale and Mondamin is reported to be under consideration.

ODEBOLT, IOWA.—An electric-light plant is being installed in Odebolt by Messrs. Russell & Fry. The proposed plant will have an output of 150 kva. For further information address H. E. Russell of Odebolt.

ROCK RAPIDS, IOWA.—Bids will be received by E. J. Reigel, auditor, Rock Rapids, until Oct. 18 for construction of court house for Lyon County at Rock Rapids as follows: (1) For building complete; (2) for building proper, exclusive of heating, plumbing and wiring; (3) for heating plant separate; (4) for plumbing; (5) for electric wiring. Plans and specifications may be obtained at the office of Joseph Schwarz, architect, Sioux Falls, S. D., and E. J. Reigel, auditor, Rock Rapids, upon deposit of $25. Copies of plans and specifications are on file at the Builders' Exchange in St. Paul and Minneapolis, Minn., and Des Moines, Iowa.

WEST UNION, IOWA.—Improvements, it is reported, are contemplated to the plant of the Turkey River Pwr. Co., West Union, to cost about $20,000, and will include a 300-kw. generating unit, consisting of turbine waterwheel and generator.

JEFFERSON CITY, MO.—The contract for electrical work in the Central Trust Building, Jefferson City, has been awarded to Charles J. Sutter, electrical engineer and contractor, 1220 Pine Street, St. Louis.

KANSAS CITY, MO.—Contracts for electrical work in connection with the new St. Joseph Hospital in Kansas City have been awarded as follows: For electric wiring, including wiring for power plant, to F. E. Newberry El. Co., St. Louis, $18,000; one 150-kw., four-valve unit, and one 100-kw., single-valve generator, 220/110 volts, three-wire, direct current, to the Ridgway Dynamo & Engine Co., Ridgway, Pa., $9,000; switchboards to William Murdock El. Co., St. Louis, $2,100; four-sweeper vacuum cleaner to the B. F. Sturtevant Co., Boston, Mass., at $1,500.

SLATER, MO.—Bids will be received by the city of Slater until Oct. 20 for furnishing and installing a 250-kva., 60-cycle, three-phase, 2300-volt alternator with exciter, directly connected to a 300-hp. engine. Bidders to furnish their own specifications and guarantees. J. A. Stern is city clerk.

CANDO, N. D.—The local electric-light plant, owned by J. C. Rader, is reported to have been purchased by the Frank A. Corson Co. of Fargo.

RYDER, N. D.—Plans are being considered by local business men to establish an electric plant in Ryder. Surveys, it is understood, have been made, together with estimate of equipment required.

ST. HILAIRE, N. D.—The Red River Pwr. Co, Grand Forks, has been granted a franchise to supply electricity in the village of St Hilaire for a period of 25 years. Energy will be supplied from the Red Lake Falls, 10 miles distant. William H. Brown is general manager.

TOWER CITY, N. D.—Preparations are being made by A. M. Voorhees to install an electric-lighting plant in Tower City. An item in the issue of Sept. 18 stated that the Council was contemplating the installation of an electric-light plant.

BROOKINGS, S. D.—Bids will be received by the regents of education, care of State College, Brookings, until Oct. 19 for the construction of a four-story brick, fireproof girls' dormitory and pavilion for the State College, at Brookings, as follows: (1) For buildings complete; (2) buildings proper, exclusive of heating, plumbing and wiring; (3) steam heating; (4) for plumbing; (5) for wiring. Plans are on file at the Builders' Exchange in St. Paul and Minneapolis, Minn. Copies of plans and

specifications may be obtained from Joseph Schwarz, architect, Sioux Falls, S. D., upon deposit of $15.

SIOUX FALLS, S. D.—A board of appraisers has been appointed to make an appraisal of the electric plant of the Consumers' Pwr. Co. with a view of its purchase by the city, to be owned and operated by the municipality.

FREMONT, NEB.—The Council is considering extending the municipal electric-lighting system to the Lee-Hall addition.

PAWNEE CITY, NEB.—Bonds to the amount of $7,000 have been voted for improvements to the municipal electric-light plant.

UNIVERSITY PLACE, NEB.—Within the next six months the water and light commission expects to purchase from 12 to 24 ornamental street lamp standards. R. S. Hyatt is superintendent.

ATTICA, KAN.—Bids will be received until Oct. 14 for the construction of a municipal electric-light plant in Attica. E. T. Archer & Co., New England Building, Kansas City, Mo., are engineers in charge. J. C. McCadden is city clerk.

ATWOOD, KAN.—Plans are being prepared for the installation of a municipal electric-light plant in Atwood, to cost about $15,000. Black & Veach, Interstate Building, Kansas City, Mo., are engineers.

HIAWATHA, KAN.—The Hiawatha Lt., Pwr. & Ice Co. is planning to increase the output of its electric plant at a cost of about $10,000. The proposed improvement is dependent upon an agreement with the city to furnish electricity for light and power.

LAWRENCE, KAN.—Bids will be received at the office of F. D. Brooks, city clerk, Lawrence, until Oct. 11 for installing an ornamental-lighting system for five blocks on Massachusetts Avenue, the equipment to include 80-100 ornamental single-lamp standards, 80-100 14-in. (diameter) Alba street-lamp globes or equal, 80-100 16-in. (diameter) Alba street-lamp globes or equal, 80-100 heavy copper ventilators for use in connection with above globes, 10-20 200-watt nitrogen-gas-filled, type C, 120-volt lamps, and 70-140 200-watt nitrogen-gas-filled lamps, type C, 115-volt lamps, or 10-20 300-watt nitrogen-gas-filled, type C, 120-volt lamps, and 70-140 300-watt, nitrogen-gas-filled, type C, 115-volt lamps, 320-400 ¾-in. by 18-in. hot-dipped galvanized anchor bolts; park and suburban cable for 220-volt insulation as follows: 160 ft. No. 2 six-conductor, 3450 ft. No. 2 six-conductor, 850 ft. No. 1 six-conductor and No. 1 ten-conductor, 3100 ft. No. 2 six-conductor and No. 1 ten-conductor cable, 1000 ft. No. 14 duplex insulated wire. Plans and specifications may be seen or obtained at the office of the city engineer, or copies of plans and specifications may be obtained at the office of the city engineer upon deposit of $5. F. D. Brooks is city clerk.

WICHITA, KAN. — Improvements are contemplated by the Kansas Gas & El. Co. on its properties, involving an expenditure of about $1,800,000, of which about $1,000,000 will be expended in Wichita and Wichita territory and the remainder on its system in Pittsburgh, and on Independence and eastern Kansas interests. The work in Wichita will include an addition to power house, 30 ft. by 100 ft., and installation of new equipment to increase the output of the plant from 12,000 hp. to 18,000 hp. Part of the funds will be used to complete the erection of the transmission line from the main line north of the city to El Dorado and intervening towns from Valley Center, the cost of which is estimated at $60,000. The cost of the transmission line to Burrton is placed at about $40,000. About $100,000 will be expended on the power plant in Pittsburgh.

Southern States

BURNSVILLE, N. C.—The Yancey Lt. & Pwr. Co., recently organized, is planning to build a hydroelectric plant, at a cost of about $16,000. Plans for the initial installation, it is reported, provide for 100 h.p., with an ultimate development of 200 hp., and 3 miles of transmission line. Charles W. Harper, engineer, of Burnside, will have charge of the work.

HICKORY, N. C.—The city of Hickory has closed a contract with the Granite Falls Mfg. Co., Granite Falls, for furnishing electricity in Hickory for a period of 30 years. Preparations are being made by the company to raise its dam in Granite Falls and increase the output of its plant from 175 hp. to 400 hp. The cost of the work is estimated at about $40,000. G. H. Geitner is president of the company.

GRAYMONT, GA.—At an election held recently bonds to the amount of $5,000 were voted for the installation of an electric-lighting system in Graymont.

NICHOLLS, GA.—Preparations are being made by the Public Utility Co., Waycross, for the installation of an electric-light plant and water system in Nicholls. The equipment will include one 50-hp. crude or kerosene engine to be used in connection with a 35-kva., three-phase, 60-cycle, 2300-volt generator (belted); also a deep-well pump, capacity of 30 gal. per minute, connected (belted) to above engine, and water tank of from 18,000 gal. to 20,000 gal. capacity. Estimates on above are now being received by the company.

BIRMINGHAM, ALA.—A proposal to install additional machinery at the municipal electric-light plant at North Birmingham in order to supply electricity for lighting the entire city and to private consumers has been submitted to the City Commissioners. The cost of the necessary machinery is estimated at about $12,000.

OKLAHOMA CITY, OKLA.—The contract for electrical work in the new State Capitol Building has been awarded to Charles J. Sutter, electrical engineer and contractor, 1220 Pine Street, St. Louis, Mo.

ATLANTA, TEX.—The Atlanta El. & Ice Co. has taken over and will operate for a term of five years the municipal water-works system. The company is contemplating installing new equipment in its electric-light plant and in the water-works system.

CELESTE, TEX.—The local electric-light plant, owned by T. J. Vines & Sons, which, it is reported, was recently destroyed by fire, will be rebuilt.

HIGHLAND PARK (P. O. DALLAS), TEX.—The City Council has entered into a contract with the Dallas El. Lt. & Pwr. Co. to install an ornamental street-lighting system in Highland Park, to cost about $9,500.

Pacific States

BELLINGHAM, WASH. — Mayor De Mattis has vetoed the ordinance authorizing the city to enter into a contract with the Whatcom County Ry. & Lt. Co., a subsidiary of the Puget Sound Trac., Lt. & Pwr. Co., to replace the present arc-lamp street-lighting system with tungsten lamps.

SEATTLE, WASH.—As an experiment, and without cost to the district, the school board will install an electric-heating system in a portable building at the Walla Walla school.

SPOKANE, WASH.—We are informed that the Washington Wtr. Pwr. Co. of Spokane does not contemplate the construction of a substation in Colfax at the present time, as reported in the issue of Sept. 18. C. S. MacCalla is vice-president and general manager.

ASHLAND, ORE.—The proposal to purchase the equipment of the California Oregon Pwr. Co. within the city limits and to purchase energy of the company at wholesale was defeated at a special election held recently.

BEND, ORE. — The steam auxiliary pumping plant of the Bend Wtr., Lt. & Pwr. Co. was recently destroyed by fire, causing a loss of about $1,200.

SUMPTER, ORE.—The Powder River Gold Dredging Co. is planning to build a new power house for dredge No. 1, below the one now in use.

BURBANK, CAL.—A special election will be held Oct. 12 to submit to the voters the proposal to issue $30,000 in bonds for the installation of an electric-lighting system in Burbank.

FRESNO, CAL.—The City Council has authorized the city attorney to draft an ordinance providing for placing all electric wires in the business district underground.

LA MANDA PARK, CAL.—The proposal to erect ornamental lamps on about 20 miles of streets, it is reported, will soon be submitted to the voters.

MARTINEZ, CAL.—The Great Western Pwr. Co. of San Francisco has applied to the Board of Supervisors for permission to extend its transmission lines from Martinez through Port Costa to Crockett, and from Concord to Walnut Creek.

BLACKFOOT, IDAHO.—The proposal to install an electric-light plant, to be driven by a Diesel oil engine, has been submitted to the Council by F. V. Riley, civil engineer, Idaho Falls.

POCATELLO, IDAHO.—The City Council, it is reported, will soon ask for bids for rewiring and repairing the lighting system in the subway and other districts.

SPRINGVILLE, UTAH.—Work has been started on the construction of a new substation at Springville to furnish energy to operate the extension of the Salt Lake & Utah Railroad from Springville to Payson. The station will be equipped with three 250-kw., 1500-volt rotary converters, three 150-kw., 44,000-volt transformers, and necessary high-tension equipment. The cost is estimated at about $60,000. Energy will be supplied by the Utah Pwr. & Lt. Co.

EUREKA, UTAH.—Arrangements are being made to equip a number of new mining properties in Tintic with electrically driven machinery. Among the mines, which will be supplied with electricity by the Utah Pwr. Co., are the Chief Consolidated, Eagle and Bluebell, each of which will use about 300 hp. The Eagle is to have an entirely new plant, while the Chief Consolidated will equip its large compressor for electrical operation. A substation to be owned jointly by the Chief Consolidated, Eagle and Bluebell and Gemini Mines will be erected at once by the Phoenix Construction Co., Salt Lake.

TUCSON, ARIZ.—The City Council is considering calling an election to submit the proposal to issue $100,000 in bonds, part of which proceeds will be used to complete the municipal electric-lighting system. C. K. Clarke is city manager.

PLENTYWOOD, MONT.—The Plentywood El. Co. has awarded the contract for the installation of a new electric light and power plant to the Sheridan El. Co., and work will begin at once on construction of plant at the Pierce and Wheeler coal mine. The power house will be 52 ft. by 50 ft. and will be equipped with two 80-hp. boilers, one 150-hp. compound Corliss engine, and a 125-kw., three-phase, 60-cycle, 2300-volt generator. When the plant is completed a twenty-four-hour service will be established.

MOGOLLON, N. M.—The construction of an electric power plant on Willow Creek is reported to be under consideration by Earle C. Cleveland. It is proposed to develop about 1500 hp.

Canada

BEETON, ONT.—The purchase of new boilers and power-house equipment for the municipal electric-light plant is under consideration by the Town Council.

CHATHAM, ONT.—Tenders, it is reported, are being received by F. P. Adams, city engineer, for machinery and equipment for the municipal electric-light plant, including gas engines and producers and electric generators.

CREDITON, ONT.—The Council is considering the installation of an electric-lighting and power distribution system.

HUMBERSTONE, ONT.—An election will soon be called to submit the by-law to enter into a contract with the Ontario Pwr. Co. of Niagara Falls for lighting the village. The by-law also provides for the installation of 67 street lamps.

MERRICKVILLE, ONT.—M. G. Henniger and J. S. Gould of Smith's Falls have purchased an interest in the Rideau Pwr. Co. of Merrickville. The company under the new management, it is understood, will enlarge the plant.

OTTAWA, ONT.—The Board of Control has recommended to the City Council that a contract be entered into with the Hydro-Electric Power Commission of Ontario for the purchase of energy to the amount of 750 hp. from the Hull & Ottawa Pwr. Co. to operate the new pumps at Lemieux Island.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Oct. 11, for furnishing motor-driven capstans at either Colon or Cristobal (Atlantic ports) or port of Ancon (Balboa, Canal Zone) (Pacific port), Isthmus of Panama, as per Circular No. 975. This circular is a readvertisement of the capstans advertised under Circular No. 962, dated Aug. 14, 1915. Major F. C. Boggs is general purchasing agent.

PANAMA.—Bids will be received at the office of the general purchasing agent, the Panama Canal, Washington, D. C., until Oct. 18, for furnishing frames and covering for flooding and sluice valves, crane runways, switch points, upright drill, switchboards, voltmeter, steel cable, barbed wire, steel or iron pipe, copper tubing, wire staples, fusible plugs, marine lamps, marine clocks, steam gages, water gages, steam gage lamps, steam whistles, automobile bells, oil cups, grease cups, etc. Blanks and general information relating to this circular (No. 974) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal. Major F. C. Boggs is general purchasing agent.

Directory of Electrical Associations

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York. Annual meeting, San Francisco, Oct. 4 to 8.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, William H. Ross, 154 Nassau St., New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, Edwin A. Scott, 29 West 39th St., New York.

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ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 62 Cedar St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, W. O. Oschman, Oliver Iron & Steel Co., Pittsburgh, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago. Annual convention, Chicago, Oct. 18-22.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. S. Hanbridge, 505 Rialto Building, Los Angeles, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, 10 Adelaide Street East, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, C. A. Littlefield, 130 East 15th St., New York.

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ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, A. D. Page, 30 Church St., New York

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, 34 Ellis St., San Francisco, Cal.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Executive secretary, A. Jackson Marshall, 29 West 39th St., New York. Sections in the principal electrical centers throughout the country. Annual convention, Cleveland, Oct. 18-19.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York. Annual meeting, New York City, Oct. 7 and 8.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Wier, Athens, Ga.

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ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. L. Blumenthal, 179 West Washington St., Chicago, Ill.

ILLUMINATING ENGINEERING SOCIETY. Assistant secretary, Joseph Langan, 29 West 39th St., New York.

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INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary, W. H. Thompson, Des Moines, Ia.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia.

JOVIAN ORDER. Jupiter (president), Homer E. Niesz, Chicago, Ill.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo. Annual meeting, Chicago, Oct. 13-15.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Mercer, 108 West Eighth Ave., Topeka, Kan.

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MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

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MINNESOTA ELECTRIC ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, H. F. Wheeler, Hattiesburg, Miss. Convention, Hattiesburg, Nov. 12 and 13.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

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NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y. Annual meeting, New York, July, 1916.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Permanent headquarters, Room 204, Hotel LaSalle, Chicago, Ill.

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NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell, N. M. Meeting, Albuquerque, Feb. 14-16, 1916.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Wm. F. Stanton, Schenectady Railway Company, Schenectady, N. Y.

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PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, H. N. Müller, 435 Sixth Ave., Pittsburgh, Pa.

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PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davison, West Virginia Water & Electric Co., Charleston, W. Va.

RAILWAY SIGNAL ASSOCIATION. Secretary-treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

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WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 21, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,153,879. PNEUMATIC GOVERNOR; B. S. Aikman, Chicago, Ill. App. filed July 31, 1911. Electric controller for air compressors.

1,153,922. TOY RAILWAY; F. J. Hummel, Pittsburgh, Pa. App. filed Feb. 25, 1915. Has special signals and signaling system.

1,153,937. TRANSMITTING TELEGAPHY KEY; T. H. Mains, Dallas, Tex. App. filed Sept. 22, 1913. Has a polarized armature.

1,153,944. MAGNETO-GENERATOR; T. W. Morgan, Waterloo, Iowa. App. filed March 26, 1912. Special timing means and has pole pieces formed from sheet metal.

1,153,960. LIGHTING FIXTURE; E. J. Schweitzer and R. G. Wagner, Los Angeles, Cal. App. filed Dec. 22, 1914. Special canopy structure for indirect lighting.

1,153,969. GAS LIGHTER; E. H. Sturts, Philadelphia, Pa. App. filed Oct. 27, 1914. Pilot light is given increased flow when gas is turned on to burner.

1,153,976. MERCURY-VAPOR APPARATUS; P. H. Thomas, Upper Montclair, N. J. App. filed Sept. 12, 1912. High-pressure type.

1,153,978. ELECTRICAL CONTROLLER; F. W. Van Ness, Milwaukee, Wis. App. filed April 18, 1910. For vacuum cleaning systems.

1,154,009. APPARATUS FOR PRODUCING GASES; R. H. Goddard, Worcester, Mass. App. filed Jan. 4, 1915. By electrolysis; production and compression of gases substantially simultaneous.

1,154,016. DYNAMIC-BRAKING CONTROLLER; C. T. Henderson, Milwaukee, Wis. App. filed Oct. 2, 1913. For alternating-current motors; braking connections maintained until motor speed is reduced to a predetermined point.

1,154,025. ELECTRIC METER; C. F. Kettering, Dayton, Ohio. App. filed May 29, 1912. Protected from short or abnormal circuits.

1,154,030. ELECTRIC SWITCH; C. J. Klein, Milwaukee, Wis. App. filed June 19, 1911. Three-point pendent push-button construction.

1,154,047. RAILWAY-CROSSING ALARM; G. Neville, Vancouver, British Columbia, Canada. App. filed Nov. 8, 1912. Dashpot construction maintains alarm.

1,154,058. RECTIFIER; L. R. Rogers, Chicago, Ill. App. filed Jan. 23, 1915. Requires no starting devices.

1,154,069. AUDIPHONE; C. Soret, Havre, France. App. filed Oct. 5, 1912. Telephone-receiver construction, insertible into the ear.

1,154,075. TLELPHONE SYSTEM; J. A. Taggart, Rochester, N. Y. App. filed Dec. 29, 1913. Automatic switching mechanism effects the trunk connection.

1,154,081. LEADING-IN CONDUCTOR; O. Weintraub, Lynn, Mass. App. filed May 14, 1912. Tungsten conductor sealed in magnesium boro-silicate.

1,154,091. ELECTROLYTIC APPARATUS; J. B. Burdett, Chicago, Ill. App. filed Oct. 29, 1912. For decomposition of water.

1,154,092. ELECTRODE FOR ELECTROLYTIC CELLS; J. B. Burdett, Chicago, Ill. App. filed Oct. 29, 1912. Reduces the internal resistance of cell.

1,154,093. INCLOSED FLAMING-ARC LAMP; T. L. Carbone, Charlottenburg, Germany. App. filed July 28, 1911. Blocks of moisture-absorbing material in the path of the circulating gases.

1,154,099. GROUND CONNECTOR; W. H. Curry, Lake City, Iowa. App. filed Feb. 25, 1913. Wire attached to pointed plug and protected by inclosing tube.

1,154,103. AUTOMATIC STEERING MECHANISM; K. Dougan, Minneapolis, Minn. App. filed April 18, 1910. Holds vessel in its course irrespective of wind and tide.

1,154,111. ELECTRIC HEATER; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed Sept. 26, 1913. For the ironing rolls of laundry machinery.

1,154,112. SOCKET FOR ELECTRIC-HEATER UNITS; W. S. Hadaway, Jr., New Rochelle, and J. Amon, New York, N. Y. App. filed Sept. 26, 1913. For supporting removable heater units.

1,154,114. STOVE; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed April 17, 1914. For bookbinder's tools.

1,154,115. ELECTRIC HEATER; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed May 14, 1914. Air heater for ocean steamships.

1,154,127. APPARATUS FOR NEUTRALIZING ELECTRIC CHARGES IN FIBROUS MATERIALS; P. Rasehorn and G. Grossman, Halensee, Germany. App. filed Jan. 15, 1913. Charge conducted away by an ionized medium.

1,154,130. CIRCUIT-CLOSING DEVICE; F. M. Rosenfeld, New York, N. Y. App. filed Jan. 15, 1915. Thumb switch for portable flashlamp.

1,154,132. HIGH-TENSION TRANSFORMER; C. Schrader, Halensee, Germany. App. filed Dec. 2, 1910. Magnetic material surrounds primary, and secondary is disposed on said magnetic material.

1,154,139. TELEGRAPH OF TELEPHONE RELAY; C. Stille, Zehlendorf, Berlin, Germany. App. filed March 21, 1914. Has two coils rotating in opposite directions and strong magnetic field.

1,154,144. THERMO-ELECTRIC DEVICE FOR THERAPEUTICS; J. B. Wagoner (deceased), Los Angeles, Cal. App. filed Aug. 31, 1914. Electrode with means indicating when current is on.

1,154,162. SIGNAL APPARATUS; D. Baker, Los Angeles, Cal. App. filed July 16, 1914. Indicates safety of bridge in respect to height of water.

1,154,184. ELECTRIC SIGNALING APPARATUS; F. B. Herzog (deceased), New York, N. Y. App. filed July 12, 1889. Fire and police precinct system.

1,154,201. SPARK-PLUG CONNECTOR; A. H. Ochs, Louisville, Ky. App. filed Dec. 21, 1914. Clamp for attaching wire end to spark plug.

1,154,226. REGISTER FOR POOL OR BILLIARD TABLES; M. L. Adler, New York, N. Y. App. filed July 1, 1913. For registering the games.

1,154,243. ADJUSTABLE LAMP FOR BEDS; A. Goldknopf, New York, N. Y. App. filed Aug. 5, 1914. Battery containing cylinder supports a lamp.

1,154,250. OPERATOR'S CALLING DEVICE; W. Kaisling, Chicago, Ill. App. filed Sept. 19, 1912. Series of impulse-controlled keys in connection with impulse mechanism.

1,154,252. RANGE FINDER; A. M. Kennedy, West Orange, N. J. App. filed Jan. 27, 1913. Does away with computation.

1,154,257. COMBINED REMOVABLE-KEY SINGLE-PIECE SHELL AND AUTOMATICALLY INTERLOCKING SHELL AND SWITCH-MECHANISM SOCKET; H. W. Lawrence, Denver, Col. App. filed May 12, 1914. One-piece porcelain shelf connection.

1,154,264. RAIL BOND; G. A. Merkt, Worcester, Mass. App. filed April 8, 1912. Rail bonds have steel terminals welded to the steel rails.

1,154,266. CIRCUIT CONTROLLER; E. J. Murphy, Schenectady, N. Y. App. filed June 28, 1912. Pawl-and-ratchet, step-by-step mechanism replaced by magnetic attraction.

1,154,270. ELECTRICALLY HEATED KITCHEN RANGE; O. Saelid and K. Pettersen, Sarpsborg, Norway. App. filed Nov. 4, 1914. Accumulator type, heating from top as well as from below.

1,154,274. LIMIT CONTROLLER FOR MOTORS; G. J. Stuart, Bellevue, Pa. App. filed Nov. 1, 1913. For gate valves, etc.

1,154,293. ELECTRICALLY PROPELLED ROAD VEHICLE; E. Cross, Rotherham, England. App. filed June 6, 1914. Combined current collector and steering arm engage the tramway rail.

1,154,306. VACUUM INDICATOR; G. F. Gray, Schenectady, N. Y. App. filed Sept. 7, 1912. For vacuum lightning arresters.

1,154,311. MECHANICAL INTERRUPTER FOR ELECTRICAL IGNITION SYSTEMS; G. Honold, Stuttgart, Germany. App. filed May 22, 1914. For abnormally high engine speeds.

1,154,320. ELECTRIC WELDING APPARATUS; O. A. Kenyon, Hastings-on-Hudson, N. Y. App. filed Oct. 29, 1912. Special provision for controlling the welded arc.

1,154,354. ELECTRIC CONNECTOR; E. F. Wakefield, Chagrin Falls, Ohio. App. filed Aug. 27, 1913. For high-tension cable.

1,154,356. ELECTRICAL HEATER FOR LIQUIDS; U. Wedge, Ardmore, Pa. App. filed Feb. 28, 1914. Insertible into a cup of coffee to warm the same.

1,154,359. PROTECTIVE DEVICE; D. Basch, Schenectady, N. Y. App. filed June 17, 1913. Operates quickly or slowly as overload is heavy or light.

1,154,377. COMPRESSION RHEOSTAT; E. L. Clark, Lakewood, Ohio. App. filed March 17, 1913. High-capacity, operated from single point.

1,154,386. MEANS FOR SUPERVISION OF MACHINE AND TOOL WORK; P. B. Delany, South Orange, N. J. App. filed March 9, 1911. Supervisor is kept informed of work done at the benches.

1,154,393. ELECTRODE FOR ARC LIGHTS; C. W. Hill, Lakewood, Ohio. App. filed Aug. 25, 1911. Good conducting portion extends beyond the shell as electrode is consumed.

1,154,394. SAFETY CONNECTION FOR ELECTRIC MAINS; M. Höchstadter, Berlin, Germany. App. filed July 25, 1911. Automatically disconnects injured portion of main when insulation breaks down.

1,154,409. ELECTRICAL HEATING UNIT; F. Kuhn and F. E. Shailor, Detroit, Mich. App. filed Oct. 16, 1909. Armed resistance from which heat is dissipated by conduction.

1,154,410. ELECTRIC HEATER; F. Kuhn and F. E. Shailor, Detroit, Mich. App. filed Jan. 31, 1914. Broiler and toaster.

1,154,411. ELECTRIC HEATER; F. Kuhn and F. W. Shailor, Detroit, Mich. App. filed June 11, 1914. Has a removable reflector plate.

1,154,412. ELECTRICAL HEATER; F. Kuhn and F. E. Shailor, Detroit, Mich. App. filed July 1, 1914. Radiator for heating rooms.

1,154,413. CONNECTOR FOR ELECTRICALLY HEATED INSTRUMENTS; F. Kuhn and F. E. Shailor, Detroit, Mich. App. filed July 9, 1914. For sadirons, etc.

1,154,414. ELECTRICALLY HEATED SOLDERING IRON; F. Kuhn and F. E. Shailor, Detroit, Mich. App. filed Aug. 21, 1914. Has a heat-dissipating surface preventing overheating of the resistor.

1,154,415. HANDLE AND TERMINAL CONNECTION FOR ELECTRICALLY HEATED INSTRUMENTS; F. Kuhn and F. E. Shailor, Detroit, Mich. App. filed Sept. 28, 1914. For soldering irons, etc.

1,154,416. ELECTRICALLY HEATED OVEN; F. Kuhn, Detroit, Mich. App. filed Oct. 31, 1914. Has naked resistor wound on frame.

1,154,417. ELECTRICAL HEATER; F. Kuhn, Detroit, Mich. App. filed Nov. 21, 1914. Naked resistor.

1,154,418. ELECTRICALLY HEATED COOKING UTENSIL; F. Kuhn and F. E. Shailor, Detroit, Mich. App. filed April 12, 1915. Chafing dish.

1,154,441. TRANSFORMER REGULATION; E. O. Schweitzer, Chicago, Ill. App. filed Dec. 7, 1910. Alternating-current transformer for maintaining pressure constant.

1,154,449. STOP MOTION FOR LOOMS; J. J. Smith, Cambridge, Mass. App. filed Dec. 19, 1914. Requires only light current.

1,154,462. WIRING SYSTEM; E. A. Walz, Jr., New York, N. Y. App. filed July 28, 1914. Direction signaling system for automobiles.

1,154,473. ELECTRIC SNAP SWITCH; J. Zakrzewski and J. Karasinski, Detroit, Mich. App. filed April 26, 1915. Operated by a single push-button.

1,154,480. FIRE ALARM; R. L. Brinkley, Winston-Salem, N. C. App. filed Jan. 11, 1915. Includes a telephone and graphophone.

1,154,496. SLOT-CLOSING DEVICE FOR DYNAMO-ELECTRIC MACHINES; W. L. R. Emmet, Schenectady, N. Y. App. filed Oct. 25, 1911. Made up of slightly separated laminations.

1,154,514. INCANDESCENT LAMP; R. Jacoby, Berlin, Germany. App. filed June 27, 1914. Contains argon and nitrogen.

1,154,549. SAFETY APPLIANCE FOR STEAM ENGINES; H. M. St. John, Passaic, N. J. App. filed June 5, 1914. Closes throttle in case of excess water from boiler.

1,154,574. REPEATER; C. D. Lanning, Dorchester, Mass. App. filed Dec. 13, 1905. For reinforcing telephonic repeated current.

1,154,576. SWITCH BOX; C. C. Maison and R. H. Robinson, St. Louis, Mo. App. filed Feb. 24, 1914. Made of built-up box units.

1,154,583. BINDING POST FOR ELECTRICAL CONDUCTORS; C. J. Klein, Milwaukee, Wis. App. filed Feb. 24, 1913. Soft-metal washer is clamped over wire end.

1,154,587. HEATING SYSTEM; H. S. Williams, Detroit, Mich. App. filed Sept. 22, 1913. Thermostatically controlled fan for circulating the heated air.

1,154,588. ELECTRIC SIGNALING SYSTEM; S. M. Young and F. Townsend, New York, N. Y. App. filed Nov. 21, 1903. For electric railways.